FNU FIJI NATIONAL UNIVERSITY

COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)

SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

TRADE DIPLOMA IN ELECTRICAL ENGINEERING - Stage 4

EEE545- ELECTRICAL MACHINES

FINAL EXAMINTION – TRIMESTER 1, 2019

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. Name at least six parts of a motor. (3 marks)

2. Briefly explain the difference between a single phase motor and a three phase motor. (4 marks)

3. Explain why single phase motors have problem with starting compared to three phase motors. (2 marks)

4. State the purpose of a run capacitor in a capacitor –start capacitor run motor? (2 marks)

5. List two applications of shaded pole motors. (2 marks)

6. List and explain at least two applications of synchronous motor (3 marks)

7. With the aid of circuit diagram, explain the load/speed and load/torque characteristics of a shunt-field motor. (4 marks)

8. State Lenz's law. (2 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 and 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 – Star b) Delta – Star (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 (Ra) of 0.18 Ω and the shunt field (R_{sh}) has a resistance of 120 Ω.

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 has 500 primary turns and 3000 secondary turns. If the primary voltage is 240V, determine the secondary voltage, assuming an ideal transformer. (3 marks)

3. 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)

4. 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.

(5marks)

5. 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 (5marks)

6. 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)

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

(4marks)

8. 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 (3 marks)
(c) the frequency of the induced e.m.f. in the rotor. (3 marks)

9. A separately-excited generator develops a no-load e.m.f. of 150V at an armature speed of 20 rev/s and a flux per pole of 0.10Wb. Determine the generated e.m.f. when

(a) the speed increases to 25 rev/s and the pole flux remains unchanged (3 marks)

(b) the speed remains at 20 rev/s and the pole flux is decreased to 0.08Wb, and (3 marks)

(c) the speed increases to 24 rev/s and the pole flux is decreased to 0.07Wb. (3 marks)

.....**THE END**.....