



FNU FIJI NATIONAL UNIVERSITY

**COLLEGE OF ENGINEERING, SCIENCE AND
TECHNOLOGY**

**SCHOOL OF ELECTRICAL AND ELECTRONICS
ENGINEERING**

TRADE DIPLOMA IN ELECTRICAL ENGINEERING – STAGE 3

EEE545 - ELECTRICAL MACHINES

FINAL EXAMINATION – TRIMESTER 3, 2018 - DURATION: 3 HOURS

DAY/DATE: APETT TIME:APETT ROOM:APETT

INSTRUCTIONS TO STUDENTS:

1. You are allowed 10 minutes extra reading time during which you are not allowed to write.
2. Begin each **SECTION** on a fresh page and use both sides of the sheet.
3. Write your candidate number at the top of each answer sheet.
4. Insert all 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 through and you must attach to the answer booklet.
6. Write clearly the number(s) of the question(s) attempted on top of each sheet.
7. Show all working where necessary
8. **ATTEMPT ALL QUESTIONS – TOTAL IS 100%**

SECTION A**(60 MARKS)**

1. Name the six parts of a motor. (3 marks)
2. Illustrate by a diagram what you understand about Fleming's left-hand rule. (6 marks)
3. Discuss using fully labelled diagrams the three compound motors that you know. (6 marks)
4. Discuss the six features of a single phase motor. (3 marks)
5. With the aid of fully labelled diagrams, illustrate the characteristics of a capacitor – start motor and its applications. (5 marks)
6. Identify the disadvantages of: (a) single-phase motors and (b) three-phase motors. (3 marks)
7. With the aid of a diagram, outline the principle of operation of a three-phase motor. (5 marks)
8. Explain the different modes of starting methods of an induction motor. (6 marks)
9. State the advantages of wound rotor induction motors. (3 marks)
10. Explain the three different types of stepper motors that you know and explain the different step modes. (6 marks)
11. With the aid of fully labelled diagrams demonstrate how the voltage is induced in a coil. (4 marks)
12. With the aid of a fully labelled diagram explain the equivalent circuit of a practical transformer. (10 marks)

SECTION B**(40 MARKS)**

1. The armature of a 6-pole, 600 rpm generator, has 90 slots. Each coil has 4 turns and the flux per pole is 0.04 Weber. Calculate the value of the induced voltage.. (5 marks)

2. A 12-pole, 72-coil dc generator generates 240 volts between adjacent brushes and delivers a current of 2400 A to the load. Calculate:
 - (a) The current delivered per brush set. (2 marks)
 - (b) The current flowing in each coil. (2 marks)
 - (c) The average voltage induced per coil. (2 marks)

3. A shunt motor rotating at 1500 rpm is fed by a 120 V source. The line current is 51 A and the shunt-field resistance is 120 ohms. If the armature resistance is 0.1 ohm, calculate the following:
 - (a) The current in the armature
 - (b) The counter emf
 - (c) The mechanical power developed by the motor. (9 marks)

4. A large transformer operating at no-load draws an exciting current of 5 A when the primary is connected to a 120 V, 50 Hz source. From a wattmeter test it is known that the iron losses are 180 W. Calculate:
 - (a) The reactive power absorbed by the core
 - (b) The value of R_m and X_m
 - (c) The value of the field current, the magnetizing current, the exciting current and the phasor diagram. (10 marks)

5. Three single-phase transformers are connected in delta-delta to step down a line voltage of 138 kV to 4160 V to supply power to a manufacturing plant. The plant draws 21 MW at a lagging power factor of 86 percent. Calculate:
 - (a) The apparent power drawn by the plant
 - (b) The apparent power furnished by the HV line
 - (c) The current in the HV line
 - (d) The current in the LV line
 - (e) The currents in the primary and secondary windings of each transformer
 - (f) The load carried by each transformer. (10 marks)

THE END

