



FIJI NATIONAL UNIVERSITY

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, 2014

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.
10. **ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE ROOM!**

SECTION A**SHORT ANSWERS****60 MARKS**

1. Name 6 parts of a motor. (3M)
2. Name three types of D.C Motor with the aid of diagram. (6M)
3. Define Permanent-Magnet DC Motor and give one advantage of it. (2M)
4. List two methods of controlling the speed of Shunt DC Motor. (2M)
5. Name two types of rotor construction of a three phase induction motor. (2M)
6. Name three factors that the voltage generated in an armature winding is dependent on. (3M)
7. State four factors on which the value of a voltage induced in a conductor depends on. (2M)
8. Draw the control part of a DOL starter and state its operation. (5M)
9. Explain in six steps why induction motor can never run at synchronous speed. (3M)
10. State four major differences between an ideal and real transformer. (4M)
11. Name three types of transformers with a brief explanation. (6M)
12. Name two types of cores for power transformer. (2M)
13. Draw the following transformer connections: (2M)
 - a) Star – Star
 - b) Delta – Star
14. What are four reasons for paralleling AC generators . (2M)
15. What four conditions must be satisfied before Synchronous generators is paralleled. (2M)
16. Name two types of stepper motors. (1M)
17. State three steps of a stepper motor. (3M)

18. Draw the schematic diagram of a split phase – single phase motor. (3M)
19. Give 5 characteristics of shaded pole motor. (5M)
20. A current flowing into the dotted and undotted end of a winding of the transformer would produce which types of mmf. (2M)

SECTION B**CALCULATIONS****40 MARKS**

1. A shunt motor rotating at 1700 rpm is fed by a 240V source. The line current is 70A and shunt field resistance is 200 ohms. If the armature resistance is 0.1 ohms. Calculate:

- a) The current in armature (1M)
- b) The counter emf (2M)
- c) Mechanical power developed by motor (2M)
- d) Efficiency (2M)

2. 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. (2.5M)
- b) Calculate the voltage generated if the armature was WAVE connected (2.5M)

3. A series motor runs at 650 rpm when taking 120A from a 239v supply. The resistance of the armature circuit is 0.1 ohms and that of the series winding is 0.02 ohms. The useful flux per pole for 120A is 0.024 Wb and that for 45 A is 0.016 Wb. Calculate the speed when the current has fallen to 45A.

(8M)

4. A 250V, 20kW, 4 poles, 50Hz, Y-connected induction motor has a full-load slip of 5%.

- a. What is the synchronous speed of this motor? (2M)
- b. What is the rotor speed of this motor at the rated load? (2M)
- c. What is the rotor frequency of this motor at the rated load? (2M)
- d. What is the shaft torque of this motor at the rated load? (3M)

5. A transformer operating at no load draws an exciting current I_0 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 (2M)
- b) Value of R_m and X_m (2M)
- c) Value of I_f , I_m , I_0 (2M)

6. 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.

(5M)

All the best....

The End