



FIJI NATIONAL UNIVERSITY

COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY

SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

**TRADE DIPLOMA IN ELECTRICAL ENGINEERING (ELECTRICAL &
RENEWABLE) - STAGE 4**

EEE536 ELECTRICAL POWER GENERATION

FINAL EXAMINATION – SEMESTER 2, 2016

Duration: 2 hours and 10 minutes

Total Marks: 100

Total No. of Pages: 5

DATE/DAY: TBA

TIME: TBA

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 SECTION 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 a string.
5. For all sheets of paper on which rough/draft work has been done, cross it through and ATTACH these to your answer scripts.
6. Write clearly the number(s) of the question(s) attempted on the top of each sheet.
7. Use of programmable calculator(s) is prohibited.
8. ANSWER ALL QUESTIONS
9. Show all working where necessary.
10. ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE EXAM ROOM

SECTION A**(25 MARKS)**

1. Discuss the functions of a “Governor” and a “Prime-mover”. **(2 marks)**
2. Explain any four major components of a Diesel Power Plant. **(2 marks)**
3. A power station has to supply load as follows:

Time (hours)	0 - 6	6 -12	12 -14	14 - 18	18 - 24
Load (MW)	45	135	90	150	75

- i. Draw the load Curve
 - ii. Draw the load duration curve
 - iii. Find the size and number of generating units together with the running hours.
 - iv. Calculate the load factor
 - v. Calculate the plant capacity factor **(9 marks)**
4. The generating station on a particular day has a maximum demand of 20MW, a load factor of 60%, a plant capacity factor of 48% and a plant use factor of 80%. Calculate –
 - i) The daily average energy produced **(3 marks)**
 - ii) The reserve capacity of plant **(3 marks)**
5. State any two advantages of interconnections of power stations. **(2 marks)**
6. A 100MW Power station delivers 100MW for 2 hours, 50MW for 6 hours and is shut-down for the rest of each day. It is also shut-down for maintenance for 65 days each year. Calculate the annual load factor. **(2 marks)**
7. Differentiate between a Substation and a Power Station? **(2 mark)**

SECTION B**(25 MARKS)**

1. Explain any four major components of an alternator. **(2 mark)**
2. A hydroelectric plant is supplied from a catchment area of 100 km^2 with an annual rainfall of 1400 mm and head of 250 m. consider the yield factor of 50% and load factor of 60 %. Calculate the power produced and the capacity of the power plant if the power plant has an efficiency of 80 %. **(6 marks)**
3. A 5MVA, 50 Hz, 3-phase star connected synchronous generator having a synchronous reactance of 25 % is running at 1500rpm and is excited to give 11000 V. Calculate the synchronizing power per two mechanical degree of displacement and the corresponding synchronizing torque. **(7 marks)**
4. Discuss any 3 requirements of synchronizing an alternator to the grid. **(3 marks)**
5. Explain synchronoscope sychronization? **(2 mark)**
6. What is motoring? **(2 mark)**
7. Tabulate the major hourly, daily/ weekly/monthly maintenance schedules for a Diesel Generator. **(3 marks)**

SECTION C**(25 MARKS)**

1. State and elaborate on some common tests that are done by Transformer manufacturer before it is dispatched for usage to consumers. **(3 marks)**
2. Tabulate the major hourly, daily/ weekly/monthly maintenance schedules for a transformer. **(3 marks)**
3. Explain any two cooling methods for a transformer. **(2 marks)**
4. i) Draw standards symbols for CTs and VTs. **(2 marks)**
ii) Elaborate on the importance of these special transformers in a substation/power station. **(1 marks)**
iii) Mention the safety precautions to be taken when connecting a CT and a VT. **(2 marks)**
5. Explain the operation of a single phase energy meter. **(2 marks)**
6. A 11kV/33kV power transformer is connected in star-delta. The C.Ts on the low voltage side has turns of 800/5. Find the suitable turns ratio for the C.Ts on high voltage side. **(5 marks)**
7. A 240V single phase energy meter has a constant load of 10A passing through it for 4.9 hours at 0.85 pf. If the meter disc makes 1000 revolutions during this period, find the meter constant in revolutions per kWh. If the power factor of the load is unity, what number of revolutions would the disc make in the above time? **(5 marks)**

SECTION D**(25 MARKS)**

1. An energy meter has a registration constant of 100rev/kWh. If the meter is connected to a load carrying 20A at 240V and 0.8 power factor for an hour, find the number of revolution made by it. If it actually makes 360 revolutions, find the percentage error and explain it from the consumer point of view. **(5 marks)**

2. a) Generators are casually disturbed by high/low intensity electrical and mechanical faults. State any 3 common electrical faults that hinder a generator's performance. **(1.5 marks)**
b) For the electrical faults stated in part (a) above, what protection devices are connected to overcome each of three faults mentioned above. **(1.5 marks)**

3. Discuss Earthing methods utilized for a Generator/Transformer in a Power Station/Substation. **(3 marks)**

4. Explain the operation of a buchhloz relay. **(3 marks)**

5. Discuss the type of faults the bucholz relay provides protection with? **(2 mark)**

6. What is the purpose of a Negative Power Sequence relay? **(2 marks)**

7. Sketch the connection of an Earth fault relay on a generator. **(3 marks)**

8. Identify any four components of a substation. **(2 marks)**

9. Explain the double bus-bar arrangement. **(2 marks)**

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