



COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY
SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING
TRADE DIPLOMA IN ELECTRICAL & RENEWABLE
ENGINEERING - STAGE 4

EEE536 ELECTRICAL POWER GENERATION

FINAL EXAMINATION – SEMESTER 4, 2013

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. A power station has to supply load as follows:

Time (hours)	0 - 5	5 - 9	9 - 15	15 - 18	18 - 21	21 - 24
Load (MW)	20	50	100	70	65	20

- 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)**
2. A 200MW Power station delivers 200MW for 2 hours, 100MW for 6 hours and is shut-down for the rest of each day. It is also shut-down for maintenance for 60 days each year. Calculate the annual load factor. **(4 marks)**
3. A generating station has a maximum demand of 35,000 kW and has a connected load of 65,000 kW. The numbers of units generated annually are 28.5×10^7 kWh. Calculate (a) Load Factor (b) Demand Factor. **(4 marks)**
4. Draw a fully labeled cross-section view of a hydropower plant. **(5 marks)**
5. State 6 major components of an electrical generator. **(3 marks)**

SECTION B**(25 MARKS)**

1. Name six components of a diesel power plant and explain the functions. **(6 marks)**
2. A hydroelectric plant is supplied from a catchment area of 90 km^2 with an annual rainfall of 1300 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 %. **(7 marks)**
3. Discuss the 5 requirements of synchronizing an alternator to the grid. **(5 marks)**
4. A 4000kVA, 50 Hz, 3-phase star connected synchronous generator having a synchronous reactance of 20 % is running at 25 RPS (revolutions/second) and is excited to give 10000 V. Calculate the synchronizing power per two mechanical degree of displacement and the corresponding synchronizing torque. **(7 marks)**

SECTION C**(25 MARKS)**

1. List down six major information likely to be present on the transformer name plate? **(3 marks)**
2. State 3 common electrical faults likely to be present on a transformer. **(3 marks)**
3. What is heat run test and why is it carried out? **(3 marks)**
4. Describe how cooling is achieved by “Oil Natural Air Forced” method for Oil Immersed Transformers. **(3 marks)**
5. Draw standards symbols for CTs and VTs and elaborate on the importance of these special transformers in a substation/power station. **(3 marks)**
6. A 33kV/11kV power transformer is connected in delta-star. The C.Ts on the low voltage side has turns of 500/5. 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. a) Generators are casually disturbed by high/low intensity electrical and mechanical faults. State 3 common electrical faults that hinder a generator’s performance. **(3 marks)**

b) For the electrical faults stated in part (a) above, what protection devices are connected to overcome each of three faults mentioned above. **(3 marks)**
2. Elaborate on the term “differential protection” which is employed for generator and transformer protection. **(3 marks)**
3. Explain the operation of a buchhloz relay. **(4 marks)**
4. List down five major components of a sub-station. **(5 marks)**
5. Compare indoor and outdoor substation. **(3 marks)**
6. Explain 2 types of bus-bar arrangements. **(4 marks)**

End of paper