



JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF ENGINEERING AND TECHNOLOGY

**UNIVERSITY EXAMINATIONS FOR THE DEGREE IN RENEWABLE ENERGY,
TECHNOLOGY AND MANAGENT**

4TH YEAR 1ST SEMESTER 2017/2018 ACADEMIC YEAR

CENTRE: MAIN CAMPUS

COURSE CODE: TET 3411

COURSE TITLE: ELECTRICAL POWER SYSTEMS

EXAM VENUE: CR

STREAM: BSc REN ENERGY TECH. & MGT.

DATE: 18/12/2017

EXAM SESSION: 9.00 – 11.00AM

DURATION: 2 HOURS

Instructions

- 1. Answer question 1 (Compulsory) and ANY other FOUR questions**
- 2. Candidates are advised not to write on question paper**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room**

Question One

- (a) By giving advantages explain why electrical energy is preferred over other forms of energy. **[5marks]**
- (ii) Depending on the form of energy converted into electrical energy, classifier the four power generating **[2 marks]**
- (iii) Draw the schematic arrangement of hydropower generation plant and explain its operation. Explain also the four major equipment of hydropower generation station (i.e. alternators, transformers and switchgear) **[6marks]**
- (iv) A hydropower generating station is supplied from a reservoir of capacity 5×10^6 cubic metres at a head of 200 metres. Find the total energy available in KWh if the overall efficiency is 75%. **[1 mark]**

Question Two

- (a) Explain the two important effects of variable load on power generating station. **[4 marks]**
- (b) Explain the meaning of the following terms as applied to power generation; **[6 marks]**
- (i) Connected load
- (ii) Maximum Demand
- (iii) Demand factor
- (iv) Average demand
- (v) Diversity factor
- (vi) Capacity factor
- (c) A generating power has a connected load of 40 MW and a maximum of 40 MW and a maximum demand of 20 MW; the units generated being 60×10^6 per annum. Calculate the demand factor and the load factor. **[4 marks]**

Question Three

- (a) With the help of a well labelled graph explain the base load and peak load from the graph, giving examples. **[4 marks]**
- (b) Explain the best method to meet load on a power generating station. **[3 marks]**
- (c) What is an interconnected system? Why is interconnected system gaining much favour although interconnection of station involves extra cost? Outline its six advantages of interconnected system **[4 marks]**
- (d) A base load station having a capacity of 18 MW and a standby station having a capacity of 20 MW share a common load . Find the annual load factors and plant capacity of the two stations from the following data: **[3 marks]**
- | | |
|--------------------------------------|----------------------------|
| Annual standby station output | = 7.35×10^6 KWh |
| Annual base load station output | = 101.35×10^6 KWh |
| Peak load on standby station | = 12MW |
| Hours of use by standby station/year | = 2190 |

Question Four

- (a) What are the four objectives of tariff? **[2 marks]**
- (b) Explain very briefly each of the five desirable characteristics of a tariff. **[5 marks]**
- (b) Explain the following methods of tariff, giving advantages where applicable. **[4 marks]**
- (i) Block tariff
- (ii) Two part tariff and
- (iii) Maximum demand tariff
- (b) Calculate the bill of a customer whose maximum demand is 100 MW, p.f is 0.8 lagging and a load factor of 60%. The tariff used is Ksh.75 per KVA of maximum demand plus 15cts per KWh consumed. **[3 marks]**

Question Five

- (a) Explain briefly the three costs that go into the generation of electrical energy. Give the expression for the overall annual cost of electrical energy generated by a power station and explain the each part of the expression. **[3 marks]**
- (b) Explain briefly the three causes and five disadvantages of low power factor. **[4 marks]**
- (c) Briefly explain the importance of power factor improvement for
- (i) Consumers **[2 marks]**
 - (ii) Power station. **[2 marks]**
- (d) A tariff in force is Ksh.50 per KVA of maximum demand per year plus 10 Cents per KWh. A consumer has a maximum of 10 KW with a load factor of 60% and a p.f of 0.8 lag. Show the effect of improving the load factor to 80 % with the same maximum demand and p.f on the total load per KWh. **[3 marks]**

Question Six

- (a) Use a well labelled diagram to show the layout of a typical a.c supply power scheme by a single line diagram indicating all the voltages. Outline briefly the functions of each of the five stages within the power supply scheme shown in the power supply scheme. **[7 marks]**
- (b) Give the three advantages and two limitations of a high transmission voltage. **[3 marks]**
- (c) Now-a-days, electrical energy is almost exclusively generated, transmitted and distributed in the form of a.c. Outline the three technical advantages and four disadvantages of the a.c system for the transmission of electrical power? **[4 marks]**

Question Seven

- (a) What is a distribution system? Explain very briefly the distribution system in general. What does it generally consist of? **[2marks]**
- (b) Use a well labelled diagram to show a single line layout diagram of a typical low voltage distribution system and explain the function of each of the three components. **[4 marks]**
- (c) Use a single line diagrams describe the radial system, ring system and interconnected system schemes of a.c distribution system. **[5 marks]**
- (d) A considerable amount of effort is necessary to maintain an electrical power supply within the requirements of various consumers. Discuss the three important requirements of a good distribution system. **[5 marks]**