



COLLEGE: COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)

SCHOOL: SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

PROGRAMME: TRADE DIPLOMA IN ELECTRICAL ENGINEERING - STAGE 4

UNIT CODE: EEE538

TITLE: ELECTRICAL POWER UTILISATION

FINAL EXAMINATION – SEMESTER 1, 2015

ROOM: AS PER TIMETABLE

TIME: 3 HOURS 10 MINUTES

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.**

1. Tariff includes the total cost of producing and supplying electrical energy. It depends upon the load condition and the magnitude of electrical energy consumed by the consumers.
 - (a) Identify four objectives of a tariff. **(6 marks)**
 - (b) Explain Flat rate Tariff with two disadvantages? **(4 marks)**

2. Light is a form of electromagnetic energy which is transmitted in waves. Each color of light has its own wavelength in the electromagnetic spectrum. The prime objectives behind the design of a lighting system are the safety and comfort of occupants. Describe the four stages of lighting design. **(6 marks)**

3. Find the total saving in electrical load and percentage increase in illumination if instead of using twelve 150W tungsten-filament lamps, twelve 80W fluorescent tubes are used. It may be assumed that there is a choke loss of 25 per cent of rated lamp wattage with average luminous efficiency throughout life for each lamp is 15 lm/W and for each tube is 40 lm/W. The coefficient of utilization remains the same in both cases. **(6 marks)**

4. A refrigerator cycle with a coefficient of performance of 2.7 is used to maintain the food compartment at 3 °C. The compartment continuously receives 1260 kJ/h of heat from the environment. The cost of electricity is 0.165 \$/kWh, and the refrigerator motor runs one-third of the time. Determine:
 - (a) The shaft power in kW the cycle requires **(2 marks)**
 - (b) The cost of the operating unit in dollars per day **(2 marks)**
 - (c) What is the rate of heat rejected to the outside **(2 marks)**
 - (d) The maximum COP if the outside temperature is 38 °C **(2 marks)**

5. Refrigeration works by removing heat from a product and transferring that heat to the outside air. The refrigeration cycle begins with the refrigerant in the evaporator. At this stage the refrigerant in the evaporator is in liquid form and is used to absorb heat from the product. When leaving the evaporator, the refrigerant has absorbed a quantity of heat from the product with low pressure and low temperature vapour. Draw and label the refrigeration cycle. **(10 marks)**

6. Name the five main components of refrigeration system and describe their functions in the system operation. **(10 marks)**

7. A slab of material 4 cm thick and 150 cm^2 in area, having a relative permittivity of 4 and power factor of 0.04 is to be heated using dielectric heating. The power required is 200W and a frequency of 30 MHz is used. Determine the voltage required and the current flow through the material. **(8 marks)**
8. The basic principles of induction heating is the same as that of a transformer which works on the principles of electromagnetic induction. If the current continues to flow in the disc, extremely high temperatures are obtained which cannot be obtained by any other method. Name the five ways in which the heat in the disc can be increased. **(5 marks)**
9. Dielectric heating is the process of heating poor conductors of electricity by means of high-frequency electrical currents. In microwave installations, the dimensions of most components are smaller than the wavelength. Name the two basic designs in the microwave installation and describe their functions in the system operation. **(4 marks)**
10. The thyristor is a silicon semiconductor device. The thyristor is normally non-conducting in both directions, but when forward biased can be switched from a non-conducting to a conducting state by injecting current into a gate electrode. List the five factors that need to be considered when applying thyristors. **(5 marks)**
11. With the aid of diagram, fully explain the concept of Thyristor burst Firing in the control of resistance heating. **(10 marks)**
12. Electricity by definition is electric current that is used as a power source. This electric current is generated in a power plant, and then sent out over a power grid to your homes, and ultimately to your power outlets. Describe these energy considerations?
- (a) Biomass energy **(2 marks)**
 - (b) Geothermal energy **(2 marks)**
 - (c) Tidal energy **(2 marks)**
 - (d) Ocean Thermal Energy Conversion **(2 marks)**
13. Resistance welding is a group of welding processes in which coalescence is produced by the heat obtained from resistance of the work to electric current in a circuit of which the work is a part and by the application of pressure. Explain the five advantages of electric resistance furnaces. **(10 marks)**

.....The End.....

