MACHAKOS UNIVERSITY

University Examinations for 2020/2021

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

SECOND YEAR SECOND TERM EXAMINATION FOR

DIPLOMA MODULE II ELECTRICAL

POWER GENERATION AND TRANSMISSION / ELECTRICAL BUILDING

SERVICES

DATE: 3/9/2021   **TIME: 11:30 – 2:30 PM**

INSTRUCTIONS:

Answer all questions

QUESTION ONE (COMPULSORY) (30 MARKS)

a)   i)   State any Two causes of poor power factor   (2 marks)

     ii)   Explain how a synchronous condenser is used to improve the power factor of a
given system   (4 marks)

b)   A single phase motor connected to 500V, 50Hz supply takes 40A at a power factor 0.8
lagging. Calculate the capacitance required in parallel with the motor to raise the power
factor to 0.95 lagging.   (5 marks)

c)   i)   Explain any Two components of an overhead line.   (2 marks)

     ii)   State any two advantages of suspension insulators.   (2 marks)

     iii)   A 33KV overhead line has 3 units in a string of insulators. If the capacitance
between pin and earth is 12% of self-capacitance. Determine the voltage
distribution and string efficiency.   (5 marks)

QUESTION TWO (20 MARKS)

a)   i)   State any four methods used to test overhead insulators.   (2 marks)

        ii)   With reference to economics of power, define the following terms

             I) Load factor

             II) Connected loads   (4 marks)

b)   i)   A generating station has a connected load of 50MW and a maximum demand of 30MW, the units generated per annum are 70×10^6. Calculate

             i) Demand factor

             ii) Load factor   (4 marks)

        ii)   With the aid of a labeled diagram, explain the operation of an hydropower plant.

                                             (5 marks)

c)   Highlight any five advantages of overhead supply system as compared to underground supply.   (5 marks)

QUESTION THREE

a)   i)   Explain the following types of tariffs

             I) Flat rate

             II) Block rate

             III) Two part   (6 marks)

        ii)   Derive an expression for Kelvins law in economics of cost.   (4 marks)

    b)   The cost of a 3 phase overhead line is Kshs.(4000a + 4000) per Km, a is the cross ectional area in cm^2. The line is supplying a load of 10MW at 66KV, 0.8p.f lagging. Energy cost Kshs.10per KWh. Interest and depreciation is 10% per annum. Calculate the most economical size of the conductor. Given specific resistance of conductor material is 10^{-6} Ωcm.   (8 marks)

e)   State any four limitations of the Kelvins law.   (2 marks)

QUESTION FOUR

a)   i)   Explain the effect of resistance, capacitance and inductance on voltage regulation of a transmission line   (2 marks)

        ii)   Explain skin effect on overhead lines and state a method of its reduction

                                              (5 marks)

b) Three conductors of a 3phase line are arranged at the corners of a triangle 3m, 4m and 5m. Calculate the inductance per Km of line when the diameter of the conductor is 1.8cm. the 3phase, 50Hz, 132KV overhead line has conductors placed 5m apart. The conductor diameter is 2cm. For a length of 200Km. Calculate the charging current per phase. (10 marks)

c) Explain any three methods of improving string efficiency of an overhead line. (3marks)

QUESTION FIVE

a)   i)   Explain the following terms

         I) Depreciation factor

         II) Space to height ratio

                                                  (4 marks)

b) A room measures 100m x 50m, the illumination required is 80/lux, and 20 fluorescent tubes gives 45/m/w, using depreciation factor and utilization factor 1.5 and 0.6. Calculate the number of twin fluorescent lamps required (8 marks)

c)   i)   Explain any Two types of corrosion (2 marks)

     ii)   With the aid of a diagram, explain the impressed catholic protection system

                                                  (6 marks)