MACHAKOS UNIVERSITY

University Examinations for 2020/2021

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

PLANT ELECTRICAL

Diploma in Mechanical Module II

Answer all questions **Time 2 Hrs**

Question 1

a) i) Name any five wiring systems (5 marks)

ii) Explain any Two areas of application of the wiring systems (2 marks)

b) Draw the symbols of the following electrical devices

i) One way switch

ii) Consumer control unit

iii) Two way switch (4marks)

c) Explain the term wiring systems (2marks)

d) Explain the factors to consider when choosing a wiring system (7marks)

Question Two

a) Explain the function of the following parts in a d.c. machine

I) Yoke

II) Field windings (4marks)

ii) Highlight any three classifications of D.C. machines (6marks)

b) A 240v d.c. shunt machine has an armature resistance of 0.2 Ω and shunt resistance of 50Ω. If the supply current is 20A. Calculate

i) E_b when operating as a motor

ii) E_g when operating as a generator (10marks)

Question Three

a) With the aid of a labeled diagram explain the consumer and supply authorities equipment's.

(10marks)

b) With the aid a table, list the PVC cable sizes and fuse ratings for

i) Lighting

ii) Socket outlets

iii) Cooker control unit

iv) Water heater

v) Main distribution board (10marks)

Question 4

a) Define the following terms

i) Conductor

ii) Insulator

iii) Semi-conductor (6marks)

b) List any five characteristics of a desirable good conductor (5marks)

c) List any four materials used as insulators in electrical (4marks)

d) List areas of application of series motors (5marks)

Question five

a) List any five characteristics of an insulator in electrical (5marks)

b) List any five qualities of a protection system (5marks)

c) A 240V series d.c. motor has an armature resistance of 0.2Ω and a series resistance of 10Ω. The supply current is 15A. Determine

i) E_b when running as a motor

ii) E_g when operating as a generator (10marks)

DIPLOMA MODULE II ELECTRICAL

POWER GENERATION AND TRANSMISSION / ELECTRICAL BUILDING SERVICES

Answer all questions **Time 2 Hrs**

Question one

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

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

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. (5marks)

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

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

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. (5marks)

Question Two

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

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

I) Load factor

II) Connected loads (4marks)

b) i) A generating station has a connected load of 50MW and a maximum demand of 30MW, the units generated per annum are $70x10^6$. Calculate

i) Demand factor

ii) Load factor (4marks)

ii) With the aid of a labeled diagram, explain the operation of an hydropower plant. (5marks)

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

Question Three

a) i) Explain the following types of tariffs

I) Flat rate

II) Block rate

III) Two part (6marks)

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

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. (8marks)

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

Question Four

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

ii) Explain skin effect on overhead lines and state a method of its reduction (5marks)

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. (10marks)

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

Electrical Building Services

Question 5

a) i) Explain the following terms

I) Depreciation factor

II) Space to height ratio

(4marks)

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 (8marks)

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

ii) With the aid of a diagram, explain the impressed catholic protection system (6marks)

DIPLOMA MODULE II ELECTRICAL CIRCUIT ANALYSIS

Answer all questions **Time 2 Hrs**

Question One

1. a) Explain the function of the following parts of a D.C. machine

I) Pole shoes

II) Armature core (4marks)

ii) A D.C. shunt motor is supplied with 230V with a current of 5A at 1000 rpm. The armature resistance and shunt are 0.2Ω and 230Ω respectively. The armature current is varied to 30A using rheostatic method. Calculate new speed. (5marks)

b) i) Explain the dynamic braking in d.c. machines (4marks)

ii) List the requirements of a good braking system (4marks)

c) Highlight any three areas of application of shunt wound D.C. motor. (3marks)

Question Two

2. a) i) For figure 1 below determine the current through the 5+ j6 resistor using the Thevenins theorem.

(6marks)

ii) State the Nortons theorem (3marks)

b) For circuit in figure 2 below, using Delta-Star, transformation, determine the supply current. (7marks)

c) For the circuit shown in figure 3 below the load impedance Z is a pure resistance. Determine the value of R for maximum power to be transferred from the source to the load.

(4marks)

Question 3

1.a) i) Explain the terms D.C transients and Time constant as applied in transients. (4marks)

ii) Draw graphs of R.L growth circuit in transients (5marks)

b) The windings of a transformer have an inductance of 5H and a resistance of 2Ω connected to a 200V d.c. supply calculate.

i) Steady state current flowing

ii) Induced voltage after 0.15

iii) Time for current to raise to 95% of its final value. (11marks)

Question 4

a) i) Explain the terms harmonics and periodic time as applied to complex waves. (4marks)

ii) State any five sources of harmonies (5marks)

b) A supply voltage V is given by

$V = (300\sin 314t + 100\sin 942t + 50\sin 1570t)V$

It is applied to a circuit with resistance of 15Ω , in series to a coil of 10mH

Determine

i) Expression for instantenous current

ii) rms current

iii) rms voltage

v) Power dissipated (11marks)

Question 5

a) Define the following terms power factor and reactive power in A.C. circuit (4marks)

b) A circuit has a resistor of 30Ω in series with an inductance of 0.2H. A 250V, 50Hz supply is connected. Determine

i) Impedance

ii) Current and phase angle

iii) p.d. across the 30Ω resistor

iv) p.d across the coil (8marks)

c) An A.C. network consists of a coil of inductance 80mH and resistance 20Ω in parallel with a capacitor of 50μF. If the supply voltage is $300V\angle 0^0$ at 50Hz supply. Determine

i) Total circuit impedance

ii) Supply current

iii) Circuit phase angle

iv) Current in capacitor (8 marks)