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(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS
UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER

MAIN EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF SCIENCE IN RENEWABLE ENERGY TECHNOLOGY

COURSE CODE: ECE 206

COURSE TITLE: ELECTRICAL TECHNOLOGY

DATE: MONDAY, APRIL, 25TH, 2022. **TIME: 12:00 – 2:00 PM**

INSTRUCTIONS TO CANDIDATES

Question ONE (1) is compulsory
Answer Any Other TWO (2) questions
Constants: $g = 9.81\ m/s^2$. ρ = density (kg/m^3) (~ 1000 kg/m^3 for water)

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 5 Printed Pages. Please Turn Over.

QUESTION ONE (Compulsory)

(a) State six factors to consider for site selection of hydropower plant. [3 Marks]

(b) Explain the following terms:

i. Demand factor

ii. Load factor

iii. Plant capacity factor

iv. Connecting load [4 Marks]

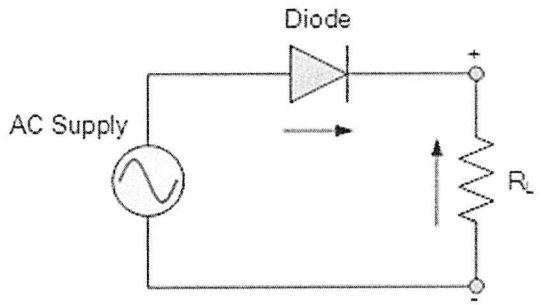
(c) A hydro power plant operates an effective head of 100 M and a discharge of 200 m^3/ sec. If the efficiency of the turbine is 0.9, find the power developed. [3 Marks]

(d) Explain the principle of Rectification. [2 Marks]

(e) State four advantages of Solid State Relays (SSRs) against electromechanical relays. [4 Marks]

(f) State and explain two types of faults in power systems. [4 Marks]

(g) A single phase half-wave rectifier is connected to a *50V* RMS 50Hz AC supply. If the rectifier is used to supply a resistive load of 150 Ohms.



Calculate the equivalent DC voltage developed across the load, the load current and power dissipated by the load. Assume ideal diode characteristics. Find the following:

i. Maximum Voltage Amplitude, V_M [2 Marks]

ii. Equivalent DC Voltage, V_{DC} [2 Marks]

iii. Load Current, I_L [2 Marks]

iv. Power Dissipated by the Load, P_L [2 Marks]

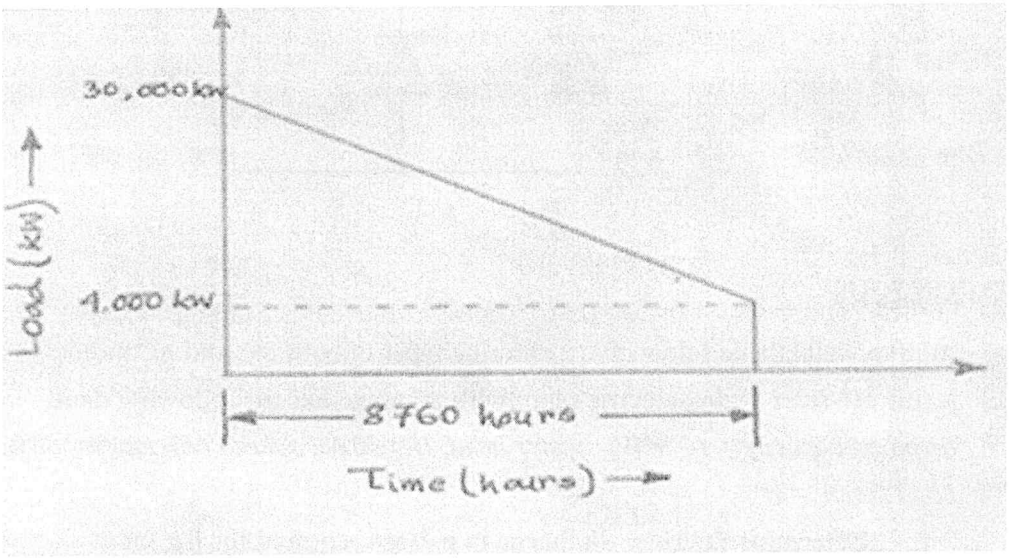
(h) Four applications of diesel power plant. [2 marks]

QUESTION TWO

a) State and explain four different types of thyristor protection schemes. [8 Marks]

b) A hydroelectric station is designed to operate at a mean head of 205 m and fed by a reservoir having a catchment area of 1000 km2 with an annual rainfall of 125 m of which 80% is available for power generation. The expected load factor is 75%. Allowing a head loss of 5 m and assuming efficiency of turbine and generator to be 0.9 and 0.95 calculate suitable MW rating of the power station. Comment on the type of turbine to be used. [6 Marks]

c) For a power station the yearly load duration curve is a straight line from 30,000 to 4000 kW. To meet the load three turbo-generators are installed. The capacity of two generators is 15,000 kW each and the 3rd is rated at 5,000 kW. Determine the following :-



(a) Load factor.

(b) Capacity factor.

(c) Maximum demand. [6 Marks]

QUESTION THREE

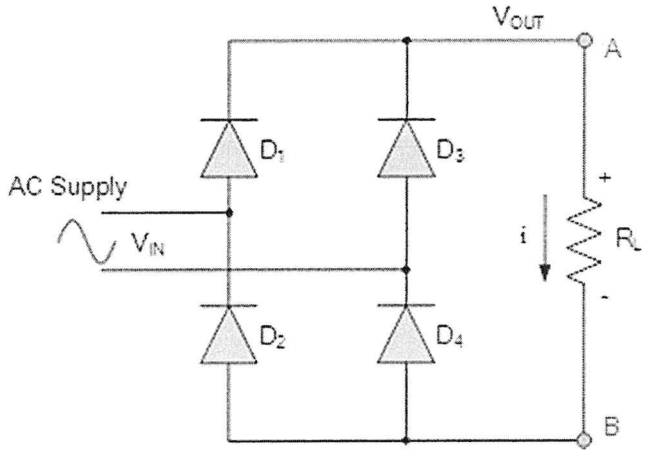
a) State factors to be kept in view while designing a power station. [2 Marks]

b) With the aid of a well labeled diagram, explain components of hydropower plants. [5 Marks]

c) State five factors to consider for site selection of Thermal power plants. [5 Marks]

d) List four methods for fault minimization in power system. [2 Marks]

e) Four diodes are used to construct a single phase, full-wave bridge rectifier circuit which is required to supply a purely resistive load of 1kΩ at 220 volts DC. Calculate the RMS value of the input voltage required, the total load current drawn from the supply, the load current passed by each diode and the total power dissipated by the load. Assume ideal diode characteristics. [6 Marks]



QUESTION FOUR

a) With a well labelled flow chart, describe types of both DC and AC motors.[4 Marks]

b) A run-off-river hydro-electric plant with pondage has the following data:
Installed capacity= 10 MW, water head, H= 20 M, overall efficiency= 80%
Load factor =40%.

i. Determine the river discharge in m^3/sec required for the plant.

ii. If on particular day, the river flow is 20 m^3/sec, what is the load factor the load can supply? [6 Marks]

c) With an aid of well labelled diagrams, explain the operation of Single Phase Full-wave Bridge Rectifier. [6 Marks]

d) Enumerates four causes of faults in power system. [4 Marks]

QUESTION FIVE

a) State types of hydropower turbines and classify according to the head and quantity of water. [6 Marks]

b) With the aid of a well labeled diagram describe the components and operating principle of steam power station. [6 Marks]

c) With an aid of well labelled diagrams, explain the operation of Fully-controlled Bridge Rectifier. [4 Marks]

d) State FOUR methods of starting 3 phase induction motors. [2 Marks]

e) State areas of frequency converter applications. [2 Marks]