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Question Paper Code : 60016

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2022.

Second Semester

Mechanical Engineering

BE 3251 — BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

(Common to : Aeronautical Engineering/Aerospace Engineering/Automobile Engineering/Biomedical Engineering/Computer Science and Design/Computer Science and Engineering/Computer Science and Engineering (Artificial Intelligence and Machine Learning)/Computer Science and Engineering (Cyber Security)/Computer Science and Engineering (Data Science)/Computer and Communication Engineering/Industrial Engineering/Industrial Engineering and Management/Manufacturing Engineering/Marine Engineering/Materials Science and Engineering/Mechanical Engineering (Sandwich)/Mechanical Engineering (Specialised in Automobile)/Mechanical Engineering (Specialised in Smart Manufacturing)/Medical Electronics/Production Engineering/Safety and Fire Engineering/Artificial Intelligence and Data Science/Computer Science and Business Systems/Information Technology)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Consider the circuit shown in figure 1. Determine the current I. [Figure 1: a 36 V source drives current I through a 15 ohm resistor, a dependent voltage source of 2VA (+ to -) and a 7 ohm resistor in series; VA is the voltage across the 7 ohm resistor]
2. Write Down the expressions for active power and apparent power.
3. A six pole lap wound DC generator has 720 conductors a flux of 40 mwb per pole is driven at 400 rpm, find the generated emf.
4. List out the application of transformers.
5. Name the four regions of operation of transistors.
6. Differentiate the operation of rectifiers and inverters.
7. Convert the given expression in canonical SOP form $Y = AC + AB + BC$.
8. Mention the significance of K-map.
9. Name the constructional parts of induction type energy meter.
10. How are the errors caused in potential transformers?

PART B — (5 × 13 = 65 marks)

11. (a) Determine the currents in the 8 ohm resistor in the circuit shown in figure 2. using mesh analysis. [Figure 2: three-row network; top row has two 4 ohm resistors in series between the left and right sides; a 24 ohm resistor connects the junction of the two 4 ohm resistors to the middle row; middle row has 2 ohm and 6 ohm resistors on either side of that junction; a 12 V source is on the left side between the top and middle rows and a 10 V source on the right side between the top and middle rows; bottom row has a 24 V source and an 8 ohm resistor in series between the left and right sides]

Or

- (b) Find the form factor of the half wave rectified sine wave shown in figure. 3. [Figure 3: half wave rectified sine wave of peak V_m , positive half cycles from 0 to π and 2π to 3π , zero from π to 2π and 3π to 4π , plotted against ωt]
12. (a) With neat diagrams explain the construction and working principle of DC generator.

Or

- (b) (i) Explain the types of DC motors characterized by the connections of field winding in relation to the armature.
(ii) Compare the operation of transformer and induction motor.
13. (a) Explain in detail the construction, principle of operation and VI characteristics of PN junction diode.

Or

- (b) Explain the constructional details and different modes of operation of MOSFET.
14. (a) Given the logical equation $Y = (A + B'C)(C + AB)$
(i) Design a circuit using AND and OR gates to realize the above function.
(ii) Realize the above function using only NAND and only NOR gates after simplification.

Or

- (b) For the truth table 1, obtain the simplified sum of products expression using k-map and realize it using only NAND gates. Observe that this is the output of a majority voting circuit. [Truth table 1 (A B C : Y): 000:0, 001:0, 010:0, 011:1, 100:0, 101:1, 110:1, 111:1]
15. (a) Explain the measurement of power in three phase circuits using two-wattmeter method.

Or

- (b) Draw the functional block diagram of Data Acquisition system and explain the role of each component.

PART C — (1 × 15 = 15 marks)

16. (a) Find the current in the 10 ohm resistance and voltage in the 2 ohm resistance in the circuit shown in Figure 4 using node analysis. [Figure 4: three parallel branches between a top and a bottom rail; left branch is a 2 ohm resistor in series with a 4 A current source; middle branch is a 10 ohm resistor; right branch is a 5 ohm resistor in series with a 2 ohm resistor, with output V_s taken across the 2 ohm resistor]

Or

- (b) In the circuit shown in figure 5, determine the total impedance, current I , phase angle θ and the voltage across each element. [Figure 5: 10 ohm resistor, 0.5 H inductor and 10 microF capacitor in series across a 50 V, 50 Hz supply]