BT MRE–I(R/S)–12.21–1067 Reg. No. | | | | | | | | |

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B.Tech. Degree I Semester Regular/Supplementary Examination in Marine Engineering December 2021

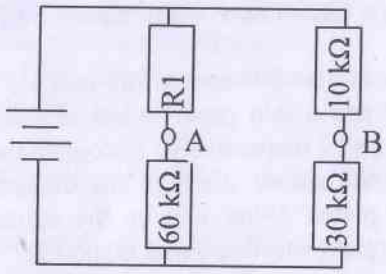
19-208-0105 BASIC ELECTRICAL ENGINEERING

(*2019 Scheme*)

Time: 3 Hours Maximum Marks: 60

(5 × 15 = 75)

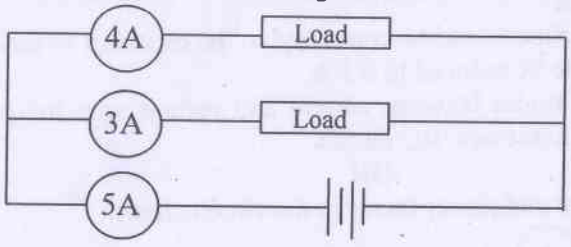
I. (a) Using network theorems, find the voltage across and current through the resistor R_1 connected as in the circuit diagram shown if the battery voltage is 50 V and $V_{AB} = 0$. (8)



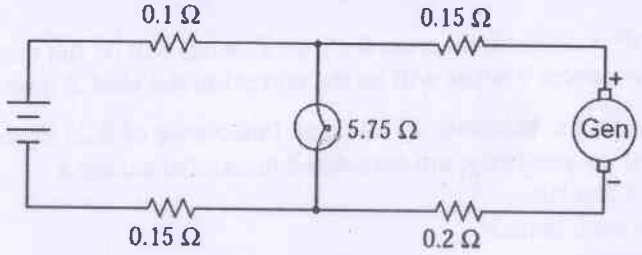
(b) A coil is wound using copper wire of length 10 m and diameter 0.25 mm. The resistivity of copper is 1.59 x 10^{-8} Ω.m at 0°C. The temperature coefficient of resistance for copper is 0.00428 / °C at 0°C. What will be the resistance of the coil if the temperature rises to 55°C when a dc source is connected across the coil terminals? (7)

OR

II. (a) While doing an electrical circuit experiment with lamp loads, you came across the situation shown diagrammatically. You feel that ALL current readings are not correct simultaneously. State the law you will apply to the circuit and explain your reasoning. Source is a 100 V battery. (5)



(b) In a remote place, a windmill driven 15 V dc generator and a 12 V battery are used in combination to supply a lamp load as shown.Values for the resistances of cables and equivalent lamp load are as shown; determine the currents in the branches using superposition. Specify the direction of flow of current in the battery. Neglect internal resistances of battery and generator. What will be the value and direction of battery current and the lamp load current if the generator voltage drops to 12 V ? (10)



(P.T.O.)

III. (a) While working on a circuit you came across a capacitor of 10 μF rating that needs replacement. You have only a few number of 4μF and 6 μF capacitors available. How will you connect these capacitors in place of the faulty 10 μF capacitor? Derive the general expression showing why it should be so connected. (8)

(b) A closed magnetic circuit of cast steel contains a 6 cm long path of cross-sectional area 1 cm^2 and a 2 cm path of cross-sectional area 0.5 cm^2. A coil of 200 turns is wound around the 6 cm length of the circuit and a current of 0.4A flows. Determine the flux density in the 2 cm path, if the relative permeability of the cast steel is 750. Permaeability of free space : $4\pi \times 10^{-7}$ H/m. (7)

OR

IV. (a) A coil having a resistance of 2 Ω and inductance of 3 H is connected to a 10 V d.c, power supply. Using a digital measurement device the current in the circuit at 0.5 s, 2 s and 50 s were recorded. What is the equation governing the current in such a circuit and what should be the current values at 0.5 s, 2 s and 50 s ? (6)

(b) Two parallel plates of size 300 mm x 300 mm are separated by a glass plate of 5 mm thickness and a thin paper board of 1 mm thickness. The relative permittivities are 8 and 2 respectively. Calculate the total capacitance and the electric field strengths across each of the dielectrics if a p.d of 10 kV is applied across the plates. What will be the capacitance if the plates were separated only by a glass sheet of 6 mm thickness? (9)

V. (a) A coil of inductance 159.2 mH and resistance 27 Ω is connected in series with a 60 Ω resistor to a 240 V, 50 Hz supply. Determine: (8)

(i) the impedance of the circuit
(ii) the current in the circuit
(iii) the circuit phase angle
(iv) the p.d. across the coil.

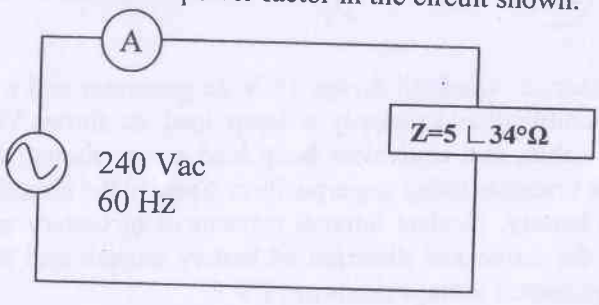
Draw the circuit phasor diagram showing all voltages.

(b) A capacitor carries a current of 1 A when a sinusoidal voltage of 230 V is applied to it at a frequency of 50 Hz. It is to be connected to a resistor network in series. Calculate (7)

(i) capacitance
(ii) resistance that should be connected to the capacitor in series if the current is to be reduced to 0.5 A
(iii) the phase angles between current and voltage with the capacitor alone and in the new RC circuit.

OR

VI. (a) Calculate the current and power factor in the circuit shown. (8)



If a capacitor of 270 μF is connected across the load Z, what will be the new power factor and line current ? What will be the current in the load Z now ?

(b) Three branches, possessing a resistance of 50 Ω, an inductance of 0.25 H and a capacitance of 100 μF respectively, are connected in parallel across a 100 V, 50 Hz supply. Calculate: (7)

(i) the current in each branch
(ii) the supply current
(iii) the phase angle between the supply current and the supply voltage. Show the phasors.

(Continued)

VII. (a) Compare hydro power stations and diesel power stations with the help of brief schematics. (7)

(b) Three coils each having 8 Ω resistance and 6 Ω inductive reactance are connected, to a 415-V, three-phase supply. For each connection, calculate the magnitude (rms value) of line and phase voltages, and the magnitude (rms value) of phase and line currents for connection. (8)

(i) in star

(ii) in delta

OR

VIII. (a) Explain in brief about the important components of a thermal power plant. (7)

(b) For a three-phase system connected in star, derive the relationship between line and phase currents using a phasor diagram. What will be the neutral current in an unbalanced star connected three phase system? (8)

IX. (a) Compare the material use in a two wire one conductor earthed DC supply system and two wire AC one conductor earthed supply system considering that both have the same maximum voltages. (8)

(b) Differentiate between HRC fuses and wire fuses. (4)

(c) What are miniature circuit breakers?. (3)

OR

X. (a) Compare with appropriate schematics, radial and ring main distribution schemes. (4)

(b) What is the purpose of installing an ELCB in lighting / appliance circuits ? (3)

(c) With a schematic diagram describe how earth electrode resistance is measured using an earth megger or earth tester. (8)

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