

B.Tech. sem-I. All Branch

**B.Tech. SEM -I (Civil/ Electrical/ Mechanical/ Production/ Computer/
Info. Tech. 2014 Course (CBCS) : SUMMER - 2019
SUBJECT: FUNDAMENTALS OF ELECTRICAL ENGINEERING**

Day Wednesday
Date: 15/05/2019

S-2019-2531

Time : 10.00 AM TO 01.00 PM
Max. Marks : 60

N. B. :

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Draw neat and labeled diagram **WHEREVER** necessary.
- 4) Assume suitable data, if necessary.

Q. 1 a) An electric kettle is required to heat 2 litres of water from 25°C to 95°C in 20 minutes. Find the rating of the kettle assuming the efficiency of 80 %. If the kettle is to operate at 230 V, find the resistance of heating element. Assume the specific heat capacity of water to be 4200 J/kg°C and 1 litre of water to have mass of 1 kg. (05)

b) Derive the expression: (05)

$$\alpha_2 = \frac{\alpha_1}{1 + \alpha_1 (t_2 - t_1)}$$

OR

a) An electric furnace is to melt 50 kg of aluminium per hour, the initial temperature of the aluminium being 18°C. (05)

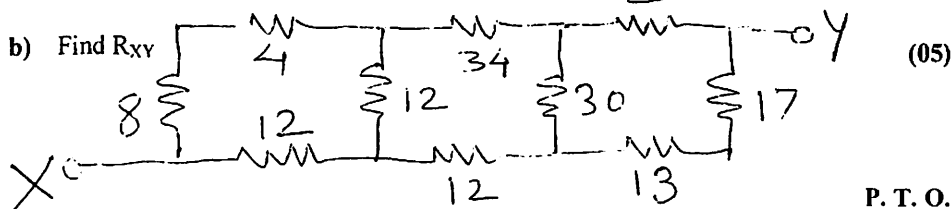
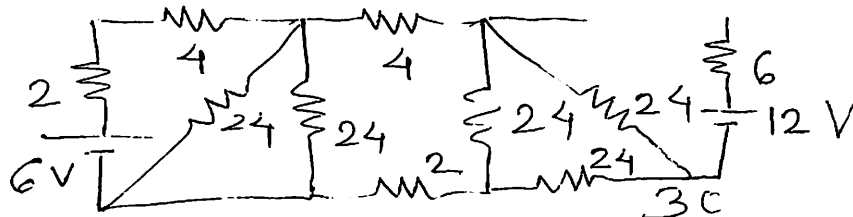
Calculate:

- i) The power required
- ii) Cost of operating the furnace for 20 hours. Aluminium has following properties:
Specific heat capacity = 950 J / kg°C
Melting Point = 660°C
Specific latent heat of fusion = 450 kJ / kg

Assume the efficiency of the furnace to be 85 % and cost of energy to be 6 Rs/unit

b) Discuss the effect of temperature on pure metals, Alloys, Insulating materials. (05)
Also draw the relevant graph.

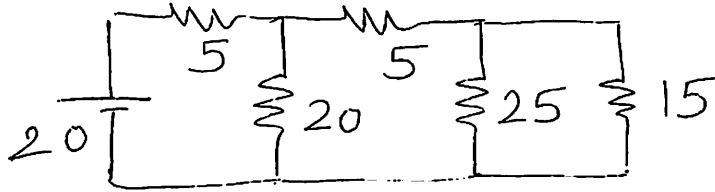
Q. 2 a) Using Superposition theorem, determine the current I as shown in network: (05)



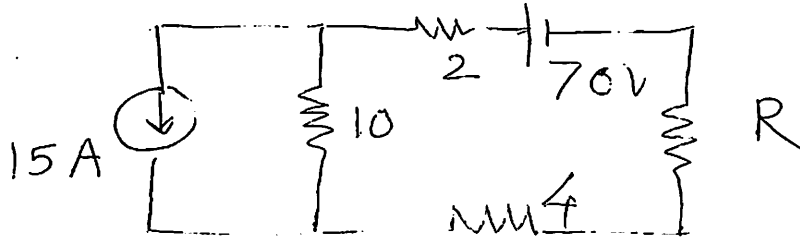
P. T. O.

OR

- a) Using Thevenin's theorem find current thro' $15\ \Omega$ resistor (05)



- b) Find the value of R for maximum power transfer (05)



- Q. 3 a) Derive an expression for capacitance a parallel plate capacitor consisting of two slabs of different dielectric materials. (05)
- b) Three capacitors have capacitances $2\ \mu\text{F}$, $4\ \mu\text{F}$ and $6\ \mu\text{F}$ respectively. Find the total capacitance when they are: (05)
- Connected in series
 - Connected in parallel

OR

- a) A $5\ \mu\text{F}$ capacitor is charged to a potential of 110 V and then connected in parallel with uncharged $3\ \mu\text{F}$ capacitor. Calculate the potential difference across the parallel capacitors. (05)
- b) What is the time constant of a series RC circuit? Derive the expression for current flowing in the circuit. (05)

- Q. 4 a) Compare magnetic and electric circuits. (05)
- b) A coil of 600 turns of resistance $20\ \Omega$ is wound uniformly over a steel ring of mean circumference of 30 cm and cross sectional area of $9\ \text{cm}^2$. It is connected to supply of 200 V. If the relative permeability of a ring is 1600. Find: (05)
- The reluctance
 - The magnetic field intensity
 - The MMF
 - The flux

OR

- a) Derive an EMF equation of 1-phase transformer. (05)
- b) A 600 kVA transformer has iron losses of 4 kW and half load copper losses are 2 kW. Calculate the efficiency of transformer at: (05)
- Half load 0.8 p.f. lagging
 - Full load 0.8 p.f. lagging

- Q. 5**
- a) Define active, reactive and apparent power. Draw the power triangle. (05)
 - b) The expression of the alternating current is given by $i = 5.48 \sin \omega t$ (05)
Calculate:
 - i) The average value
 - ii) The rms value of current
 - iii) Power consumed if the current is passed through a resistance of 10Ω

OR

- a) Sketch and explain phasor diagrams of R-L-C series circuit when; (05)
 - i) $X_L > X_C$
 - ii) $X_L < X_C$
 - b) Derive an expression for instantaneous current and power consumed when (05)
voltage of $v = V_m \sin(\omega t)$ is applied to pure inductance. Also draw phasor diagram.
- Q. 6**
- a) State various types of electrical wiring. Explain any one in detail. (05)
 - b) Write a note on incandescent lamp. (05)

OR

- a) What is earthing? Explain the significance with diagram. (05)
- b) State and explain various components of electricity bill. (05)

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