2017
ELECTRICAL ENGINEERING - PAPER-I

BM–(O)EE–I/17

Time Allowed : 3 Hours

Full Marks : 200

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answers may be given either in <u>English</u> or in <u>Bengali</u> but all answers must be in one and the same language.

All symbols have their usual significance.

GROUP-A

Answer any 3 questions.

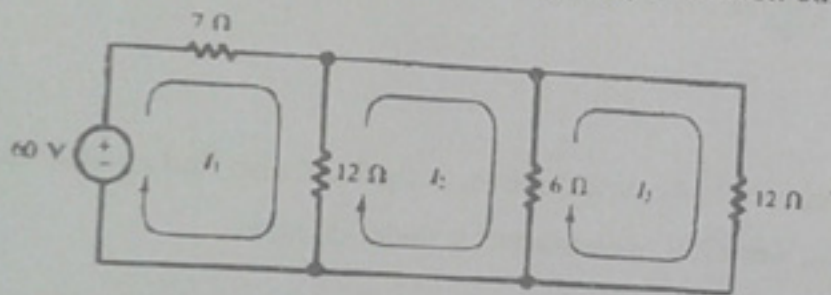1 a) Find the currents, I_1, I_2 & I_3 in fig.1 by the mesh current method.

Fig.1

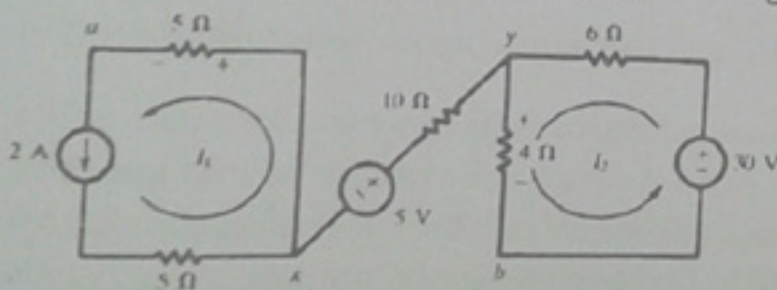b) Find the voltage V_{ab} in the network shown in fig.2.

Fig.2

c) Obtain the Thevenin and Norton equivalent circuits for the active network in Fig. 3. With terminals 'ab' open, the two sources drive a clockwise current through the 3Ω and 6Ω resistors.
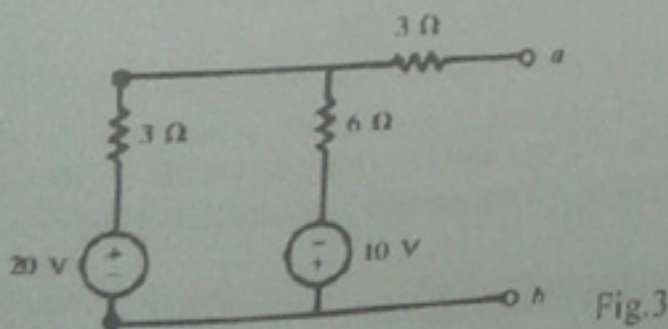

Fig.3

d) Derive an expression for self-inductance per unit length of a Co-axial Cable having solid inner conductor of radius R_1 and outer conductor of radius R_2 with negligible thickness.

10+10+10+10+10= 40

P.T.O.

2. a) A signal source v_f with no connection to ground, called a floating source, is amplified by the circuit in fig 4, find v_0
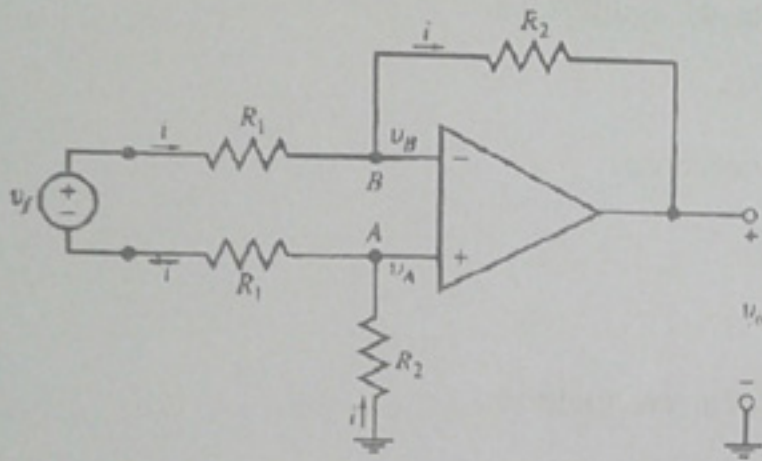

Fig.4

b) Derive second-order differential equation of current in the circuit shown in fig.5 and also find an analytical solution of the equation and plot current vs. time, when it is over-damped & under-damped.
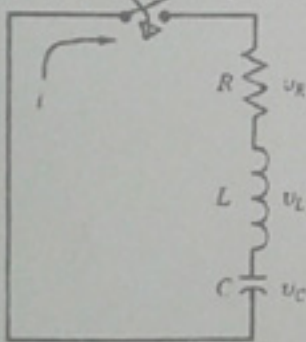

Fig.5

c) How much capacitive VAR must be provided by the capacitor bank in Fig.6 to improve the power factor to 0.95 lagging.
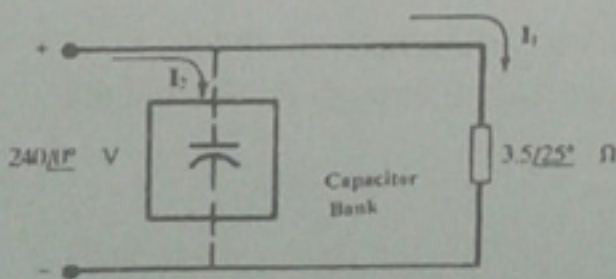

Fig.6   10+20+10=40

3. a) A thin ring of square current loop having each side of 5 cm and the ring carries 50 A , using Biot-Savart law find H on a corner positioned at a height of 10 cm parallel to the axis of the loop.

b) Establish $\nabla \times H = J + \partial D/\partial t$ and show the pictorial view of this relation.

c) Establish the boundary relation for magnetic field when it passes through two different magnetic media having permeabilities µ1 and µ2. Show one example for application of boundary relation for magnetic field.

20+10+10=40

4. a) Describe the operation of J-K flip-flop.

b) Explain working of totem pole circuit using transistors.

c) Establish "Poynting Theorem". What is Poynting vector?

d) What do you understand by Magnetic Vector Potential? Deduce Biot-Savart Law.

10+10+10+10=40

5. Write short notes on any **FOUR** of the following:-

a) Sample & Hold circuit, b) RAM & PROM, c) Shift Register,

d) Electromagnetic Maxwell's equations and e) FFT & DFT.   10×4=40

GROUP-B

Answer any 2 questions

6. a) Describe Construction and Principle of operation of a Dynamometer (or) Electromagnetic moving coil instrument.

b) Describe with diagram and derivations how Torque is develop in an electrostatic instrument.

c) The pointer of a moving coil instrument gives full scale deflection of 20mA. The potential difference across the meter when carrying 20mA is 400mV. The instrument to be used is 200A for full scale deflection. Find the shunt resistance required to achieve this. If the instrument to be used as a voltmeter for full scale reading with 1000V, Find the series resistance to be connected it?

d) Describe Measurements of inductance by Maxwell's inductance bridge.

10+10+10+10=40

7. a) Explain in detail the 8085 interrupt structure.

b) Why do we need A/D converter and D/A converter? Draw the block diagram to interface 8085 microprocessor with A/D convertor and D/A convertor.

c) Why do we need opto-isolator circuit between microcontroller and the Stepper motor?

d) Draw the pin diagram of 8051 microcontroller and explain its port structure.

10+10+10+10=40

8. a)Sketch the Nyquist plot for the open loop transfer function

$G(s)H(s)=1/[s4(s+1)]$.

b) Draw the Bode plot of the open loop transfer function

$G(s)= 200(s+10)/[s(s+5)(s+20)]$.

c) Obtain the unit step response and unit impulse response of the following system

$C(s)/R(s)=10/[s^2+2s+10]$.

d) Write short notes on Root locus construction. $10+10+10+10=40$

9. Write short notes on following:- $10×4=40$

a) Nyquist stability criterion.

b) D-Arsonval Galvanometer,

c) Dynamometer (or) Electromagnetic moving coil instrument as wattmeter,

d) Internal block diagram of 8086 and the bus interface unit and execution unit.

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