EEE (1)

Name of the Program: B. Sc. Engg. (EE)
Semester: 2nd Semester

Date: May 3, 2023
Time: 10:00 am – 1:00 pm

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Semester Final Examination
Course No.: EEE 4201
Course Title: Electrical Circuit II

Summer Semester, A.Y. 2021 – 2022
Time: 3 Hours
Full Marks: 150

There are **2 (two)** questions. Answer all **2 (two)** questions. The symbols have their usual meanings. Marks of each question and corresponding COs and POs have been written in the brackets on the right margin. Programmable calculators are not allowed. Do not write on this question paper. Assume suitable values for any **missing data**.

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1. a) Illustrate that a $3-\emptyset\ 3-w$ system is more cost efficient than a $1-\emptyset\ 2-w$ system when both the systems transfer same amount of electric power to their respective loads. Sketch necessary circuit diagrams to supplement your answer. (10) (CO1) (PO1)

b) For the two-port network depicted in Fig. 1, construct the equivalent two-port network with the hybrid parameters. (10) (CO1) (PO1)

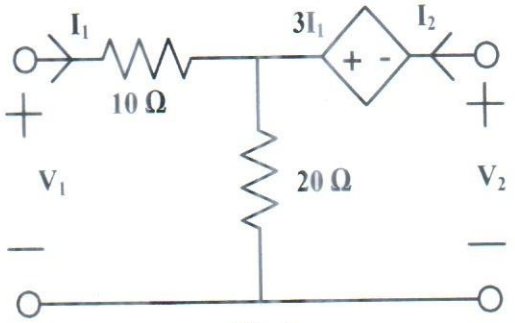

Fig. 1

c) Demonstrate that power factor correction (PFC) is beneficial for both power companies and consumers alike with appropriate vector and circuit diagrams. (10) (CO1) (PO1)

d) Construct the dual of the circuit shown in Fig. 2. (10) (CO1) (PO1)

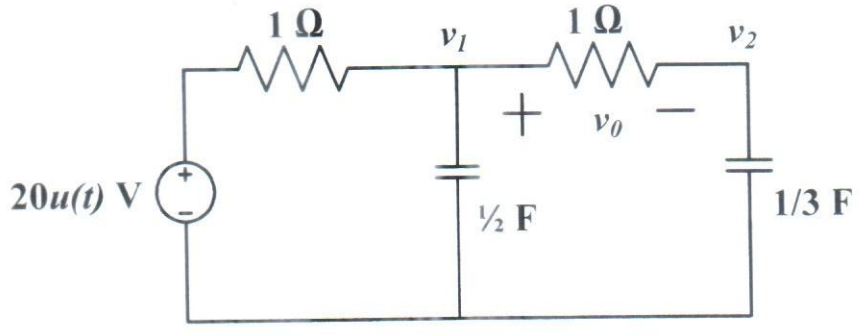

Fig. 2

2. a) For the mutually inductive circuit in Fig. 3, determine the equivalent inductance between the terminals a – b. The arrow indicates the direction of current flow, I. (05) (CO2) (PO2)

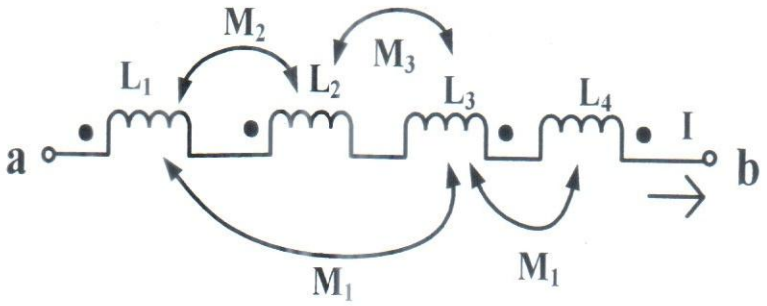

Fig. 3

b) Find out the mesh equations for the circuit depicted in Fig. 4. (05) (CO2) (PO2)

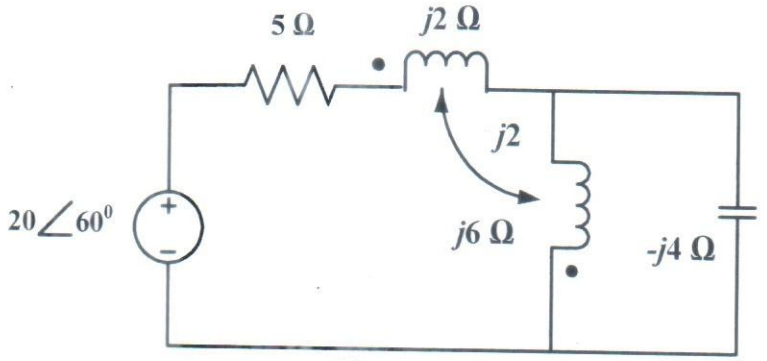

Fig. 4

c) Analyze the quality factor and bandwidth of a series resonant RLC circuit. Evaluate their codependence in terms of the following narratives: (10) (CO2) (PO2)

i. Necessary response curves,
ii. Necessary expressions for bandwidth and quality factor, and
iii. Symmetry of the response curves.

d) Determine the type of the filter depicted in the circuit of Fig. 5. Calculate the transfer function, cutoff frequency/frequencies, poles, and zeros for the filter response. (15) (CO2) (PO2)

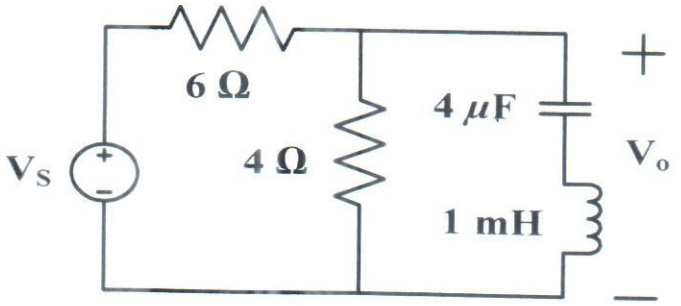

Fig. 5

e) Analyze the source-free response and step responses of an RC circuit and the source-free response and step responses of a series RLC circuit. Dissect the response curves for each aforementioned circuit for $v(t)$ and $i(t)$ for different states of V_S and V_0. Differentiate between the natural, forced, transient, and steady-state responses of $v(t)$ and $i(t)$ with appropriate response curves. (25) (CO2) (PO2)

f) For the circuit in Fig. 6, find $v(t)$ for all t and sketch the waveshape for $v(t)$. (25) (CO2) (PO2)

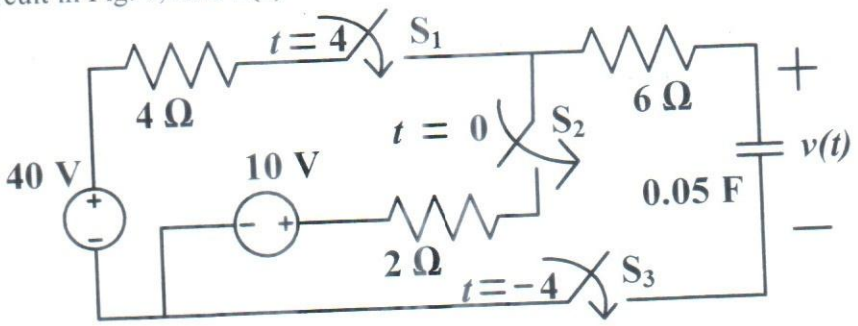

Fig. 6

g) For the circuit shown in Fig. 7, calculate: $i(0^+)$, $v(0^+)$, $v_R(0^+)$, $i(\infty)$, $v(\infty)$, $v_R(\infty)$, $\frac{di(0^+)}{dt}$, $\frac{dv(0^+)}{dt}$ and $\frac{dv_R(0^+)}{dt}$. (25) (CO2) (PO2)

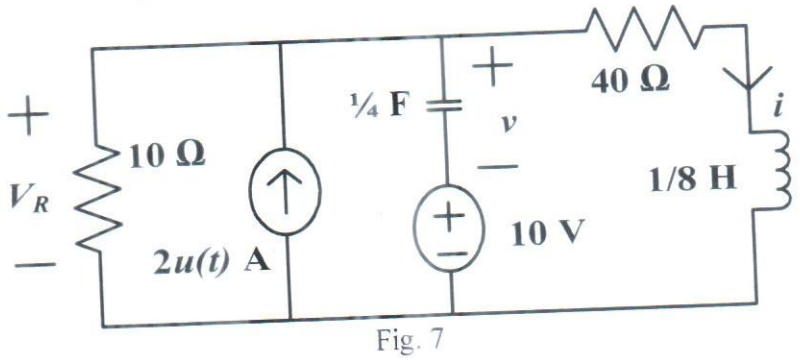

Fig. 7