Name of the Program: B. Sc. in EEE
Semester: 2nd Semester

Date: March 29, 2021
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. 2020 – 2021
Time: 3 Hours
Full Marks: 150

There are **3 (three)** questions. Answer all **3 (three)** questions. The symbols have their usual meanings. Marks of each question and corresponding COs and POs are written in the brackets. 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) Explain singularity function in the light of circuit operations and mathematical operations. (5 × 6 = 30) (CO1) (PO1)

   b) Exemplify the comparative analysis between source-free response and step response of an RLC series circuit.

   c) Locate the set of information obtained from the placement of power triangle in different quadrants in a Cartesian plane.

   d) Illustrate the meaning of damping in terms of passive elements of a DC circuit.

   e) Interpret the quality factor and bandwidth of a resonant circuit. Explain their codependence with appropriate diagrams and expressions.

   f) Formulate a passive bandstop filter and explore different salient aspects of this filter.

2. a) Deduce and sketch the step response of an RL circuit. (5 × 6 = 30) (CO2) (PO2)

   b) Summarize the concept of duality and its applicability for electrical circuits in linking parallelism between similar circuits.

   c) Evaluate the significance of shifting or scaling property of a unit impulse applied to a practical dc circuit with proper reasoning.

   d) Interpret the states of different circuit parameters of an electrical circuit under resonance.

   e) Assess all the possible balanced $3-\varphi$ systems and recommend the best one of these with proper justification.

   f) Justify the formation of the negative regions on the graph of the instantaneous power, $p(t)$, based on the offset value of $p(t)$.

3. a) Solve for the voltage, $v(t)$ of a circuit described by the integrodifferential equation: (05) (CO3) (PO3)

$$\frac{d^2v}{dt^2} + 2\frac{dv}{dt} - 10\int v\,dt + 5v = 50\sin(5t - 30^0)$$

b) For the mutually inductive circuit in Fig. 3(b), solve for the equivalent inductance between the terminals a – b. The arrow indicates the direction of current flow. (05) (CO3) (PO3)

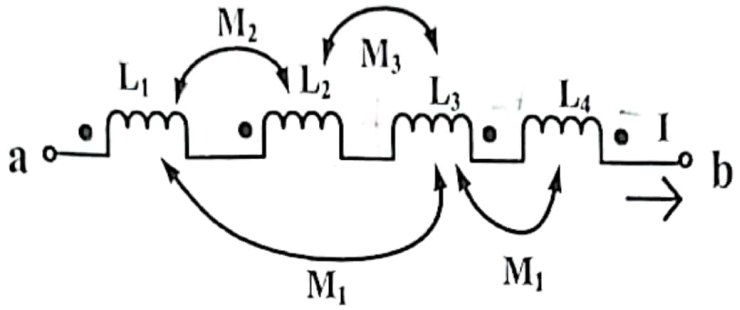


Fig. 3(b)

c) Solve for $i(t)$ depicted in Fig. 3(c) in terms of singularity functions only. (05) (CO3) (PO3)

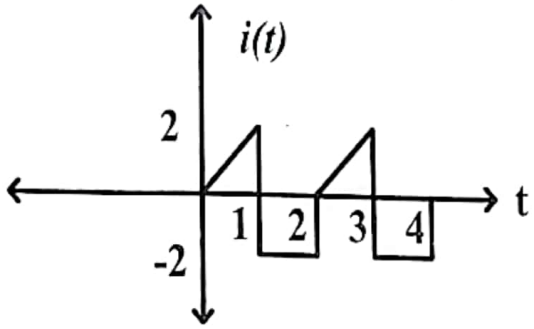


Fig. 3(c)

d) Formulate the mesh equations for the circuit in Fig. 3(d). (05) (CO3) (PO3)

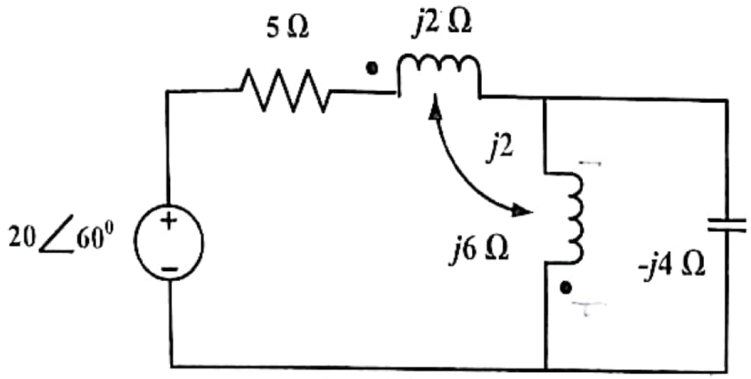


Fig. 3(d)

e) Solve for the dual parameters of the circuit in Fig. 6 and sketch the dual circuit. (05) (CO3) (PO3)

4. a) Deduce the node equations and solve for the current $I_0$ for the circuit in Fig. 4(a). (15) (CO3) (PO3)

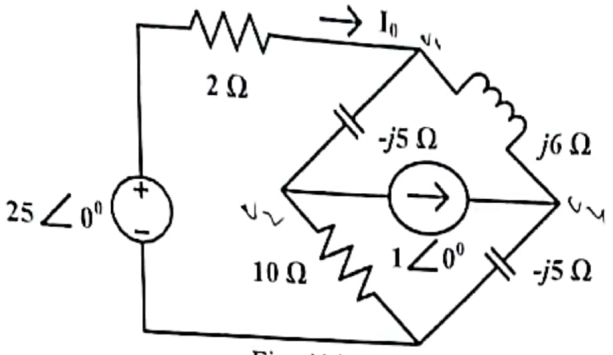


Fig. 4(a)

b) The switch for the circuit in Fig. 4(b) is closed at $t = 0$. Find $i(t)$ and $v(t)$ for all time. (15) (CO3) (PO3)

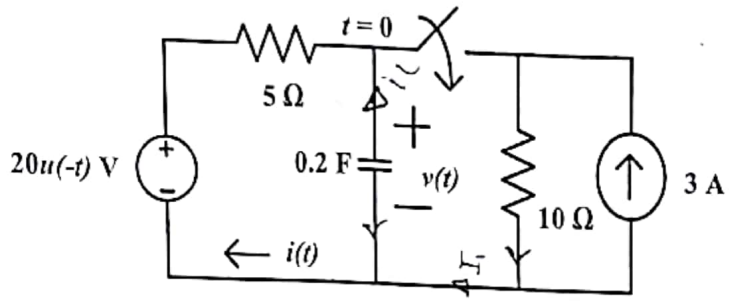


Fig. 4(b)

5. For the circuit in Fig. 5, solve and sketch the waveshape for $v(t)$. (15) (CO3) (PO3)

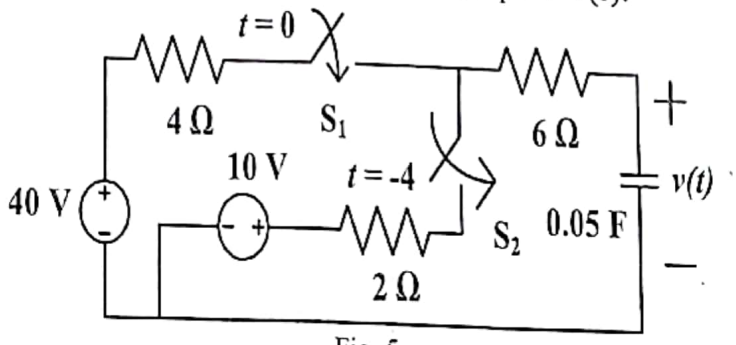


Fig. 5

6. For the circuit in Fig. 6, solve for: $i(0^+)$, $v(0^+)$, $v_R(0^+)$, $i(\infty)$, $v(\infty)$, $v_R(\infty)$, $\frac{di(0^+)}{dt}$, $\frac{dv(0^+)}{dt}$ and $\frac{dv_R(0^+)}{dt}$. (20) (CO3) (PO3)

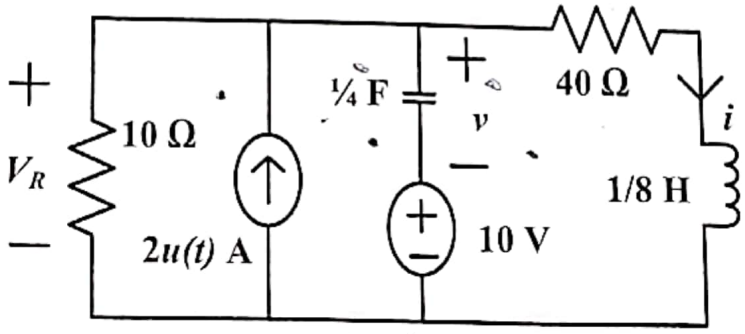


Fig. 6