INTERNATIONAL CENTRE FOR APPLIED SCIENCES
MAHE, MANIPAL

B.Sc. (Applied Sciences) in Engg.

End – Semester Theory Examinations – Nov./ Dec. 2020

II SEMESTER - ELEMENTS OF ELECTRICAL AND ELECTRONICS ENGINEERING (IEE 121)

(Branch: Mechatronics)

Time: 3 Hours **Date: 05 December 2020** **Max. Marks: 100**

- ✓ **Answer any FIVE full questions.**
- ✓ **Missing data, if any, may be suitably assumed**

Q1A Using Nodal voltage analysis determines the node voltage V1, V2, V3, and power absorbed by the resistor R=20 ohms in the circuit shown in Fig.Q1A. **10 Marks**

Q1B A choke coil is connected in series with a 35ohms pure resistance. When a 230V 50Hz single-phase AC supply is applied to this series network, the voltage drop across the coil is 100V, draws a current of 4A. Determine the following **10 Marks**

i. Resistance of coil
ii. The inductance of the coil
iii. Power loss in the choke coil.
iv. Power factor of the circuit.
v. Draw neat phasor diagram taking supply current I as reference.

Q2A Determine the equivalent resistance between points A and B of the network shown in Fig. Q.2A **10 Marks**

Q2B A Single-phase 400V, 50Hz, load consumes 40KW active power at a power factor 0.5lagging. It is proposed to improve the power factor to 0.98lagging by connecting a parallel capacitor across the load. Calculate the KVAR rating and capacitance of the capacitor required. **10 Marks**

Q3A 250V 50Hz single phase ac supply is supplying a series-parallel circuit shown in Fig.Q.3A. Determine the following **10 Marks**

i. Current drawn from the source and current in all the branches
ii. Power factor of the circuit
iii. Active power consumed by the circuit

Q.3B. A balanced three-phase star-connected load supplied by a 400V three phase 50Hz AC supply. Load draws a lagging line current of 25A, and active power consumed by the load is 13.856KW. Determine the following **10 Marks**

I. Resistance and inductance of load per phase
II. Total reactive power demanded by the load
III. Apparent power absorbed by the load

Assume phase voltage V_R as the reference phasor

Q.4A A Common source BJT amplifier utilizes voltage divider biasing, as shown in Fig.Q.4A. Determine the following **10 Marks**

i. Quiescent base currents I_{BQ}
ii. Quiescent collector current I_{CQ}
iii. Quiescent collector to emitter voltage V_{CEQ}.

Assume V_{BE}=0.7V,β=100,

Q.4B Design an adjustable LM7805 based adjustable voltage regulator to regulate the output voltage 8V to 12 V from a 15V DC source. Assume the I_{adj} =100µA and the feedback resistance between the output and adjustable pin, R1= 1KΩ, V_{ref}=5. **10 Marks**

Q.5A With a neat schematic diagram and relevant equations, explain the working of a single-phase transformer. Also, list the various losses associated with transformer **12 Marks**

Q.5B With a neat block diagram, explain the Digital communication system **8 Marks**

Q.6A With a neat circuit schematic and input-output voltage waveform explain the working of a full-wave bridge rectifier. Hence derive the expression for dc output voltage and ripple factor of output voltage without filtering capacitor. **10 Marks**

Q.6B For the circuit shown in Fig.Q6B. Calculate the following

1. Base current I_B
2. Emitter current I_E,
3. Bias and collector resistances R_C,R_B

5 Marks

Choose $V_{BE} = 0.6\,V$, $I_E = 2\,mA$ $\beta = 100$ $V_E = 2\,V$, $V_C = 10\,V$

Q.6C With a neat circuit schematic design, LM317 based voltage regulator to get an output voltage of 2V to 10V. Assume resistance connected between out pin and adjust pin (R1) is 1KΩ, Assume V_{ref}=1.25V, I_{adj}=100µA, and Vin =12V **5 Marks**

Q.7A In a series-parallel circuit, the two parallel branches A and B are in series with the branch C. The impedances are Z_A= (10+j8) Ω, Z_B= (9-j6) Ω and Z_C= (3+j2) Ω. The voltage across the branch C is$(100 + j0)\,V$. Find the branch current I_A and I_B and the phase angle between them. Draw the phasor diagram **10 Marks**

Q.7B A single-phase 50 Hz, 500V transformer has 400 primary and 1000 secondary turns. If the net cross-sectional area of the core is 60cm$^{2.}$ Determine the following

1. The peak value of the flux
2. Flux density in the transformer core
3. EMF induced in secondary with 500V across the primary winding.
4. Number of secondary turns required to induce an EMF of 2500V in the secondary winding.
5. List out the losses in full loaded single phase transformer

5 Marks

Q.7C Using source transformations, determine the voltage drop V_R across the 10 ohm resistor in the circuit shown in Fig.Q7C **5Marks**

Q.8A Using the mesh current analysis, find the power supplied by the voltage source V_A in the circuit shown in Fig.Q8A. **10 Marks**

Q.8B With a neat circuit prove that two watt meters are sufficient to measure three-phase power consumed by a balanced star-connected three-phase load. **10 Marks**

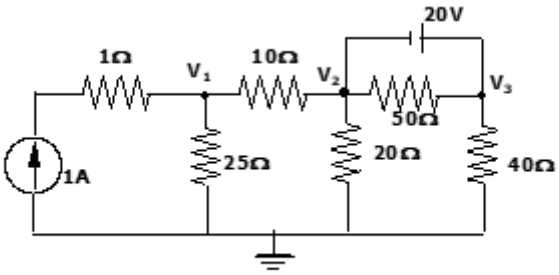

Fig.Q1.A

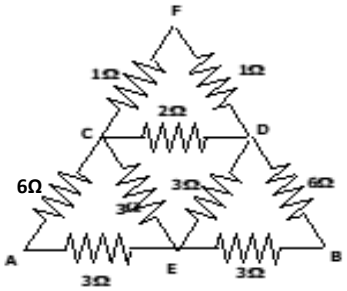

Fig.Q.2A.

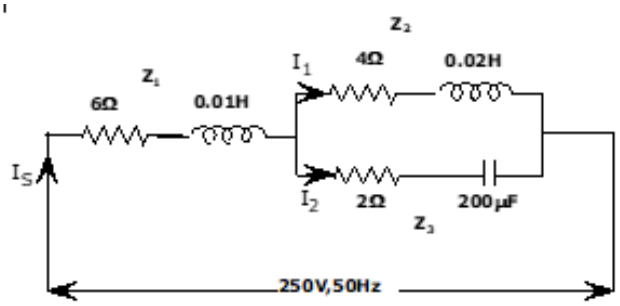

Fig.Q.3A.

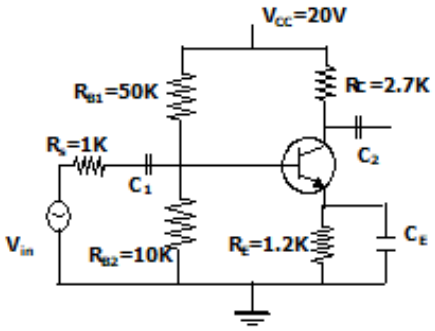

Fig. Q.4A

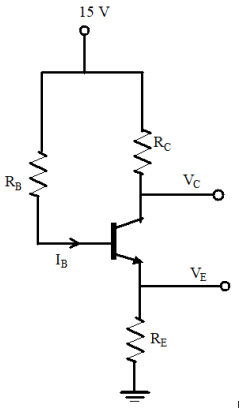

Fig Q6B.

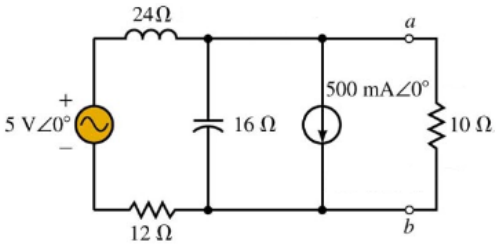

Fig.Q7C

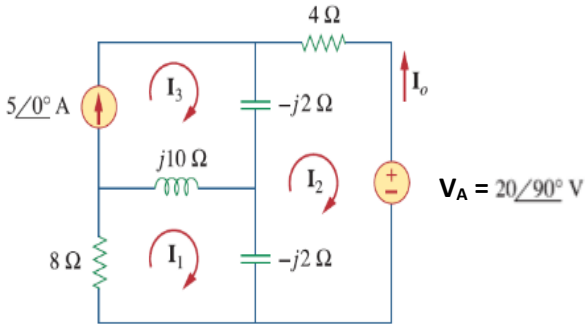

Fig. Q.8A

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