अनुक्रमांक/ Roll No.

Candidate should write his/her Roll No. here.

Total No. of Questions : **03** No. of Printed Pages : **4**

M-SFS-I-2017 (15)

ELECTRICAL ENGINEERING

(Optional Subject)

First Paper

Time : 3 Hours] [Total Marks : **200**

Instructions to the candidates :

1. This question paper consists of **three** questions and all questions are compulsory.

2. Marks for each question have been indicated on the right hand margin.

3. There is no internal choice in Question No. 1, remaining questions carry internal choice.

4. The first question is of very short-answer type consisting of **15** compulsory questions. Each one is to be answered in one or two lines. Question No. 2 is short answer type, word limit is **100**. Question No. 3 is long answer/Essay type, word limit is **300**.

5. Wherever word limit has been given, it must be followed to.

6. Question should be answered exactly in the order same as mentioned in the question paper. Answer to the various parts of the same question should be written together compulsorily and no answer of the other question should be inserted between them.

1. Attempt all questions. Give answer for the following questions in **two** lines. **$15 \times 4 = 60$**

   (A) Define time constant of a circuit.

   (B) Two capacitors of 1 μF and 2 μF are connected in parallel across a 100 V dc supply. Find the charge on capacitors.

   (C) Write the Poisson's equation and Laplace equation.

   (D) Find the force of interaction between two charges spaced 10 cm apart in a vacuum. The charges are 4×10^{-8} and $\bar{6} \times 10^{-5}$ coulomb respectively.

   (E) What is the advantage of multi-meter over other measuring instruments ?

   (F) What is the essential difference between a moving coil and moving iron instrument ?

   (G) Draw the input and output characteristics of a PNP transistor in common base configuration.

   (H) Simplify the function : $Z = AB + BC + CA$

   (I) Write the basic requirements for the successful firing of thyristor.

   (J) Mention some of the industrial applications of inverters.

   (K) Draw the symbol and v-i characteristics of triac.

   (L) What do you mean by a discrete time signal ?

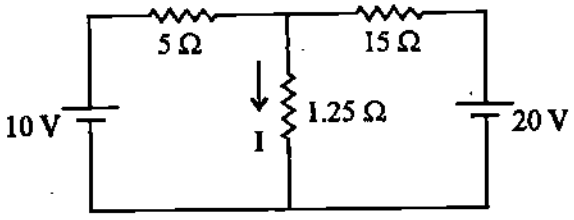
   (M) What do you mean by transfer function of a system ?

   (N) State Kirchhoff's voltage law.

   (O) What is Piezoelectric effect ?

2. Write the answer for any **ten** questions from the following questions in **100** words. **$10 \times 8 = 80$**

   (A) In the given circuit, find the current I by the mesh method.

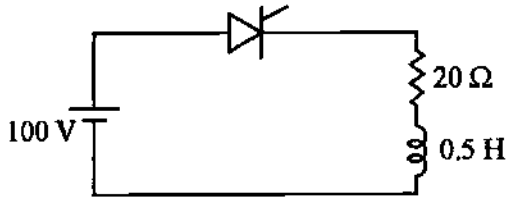


   (B) Derive the expression for torque equation for a moving iron instrument and comment upon the nature of scale.

(C) Describe the working principle and construction of an induction type wattmeter.

(D) Draw block diagram of a CRO and explain the function of each block and explain its working.

(E) The latching current of a thyristor circuit given in figure is 50 mA. The duration of the firing pulse is 50 μs. Will the thyristor get fired ?



(F) With the circuit diagram and output voltage waveform, explain the principle of operation of a chopper.

(G) Explain the operation of single phase, half controlled bridge converter with resistive load.

(H) Obtain the step response of series RL circuit using Laplace transform.

(I) Find DFT of the following sequence : X(n) = {1, 2, 3, 4}.

(J) Determine the force between two parallel conductors of length 1 m separated by 50 cm in air and carrying currents of 30 A,

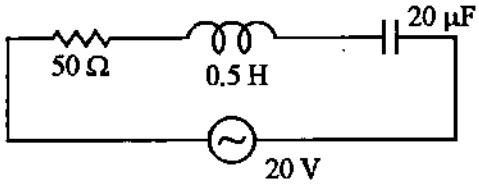
(a) in the same direction.

(b) in the opposite direction.

(K) Find the velocity of a plane wave in a lossless medium having a relative permittivity of 4 and a relative permeability of 1.2.

(L) Three choke coils, each having a resistance of 3Ω and reactance of 4 Ω, are connected in star across a 400 V – 3 phase supply. Calculate the phase current, line current and the power input.

(M) For the circuit shown in figure determine the frequency at which the circuit resonates. Also find the voltage across the capacitor at resonance and Q factor of the circuit.



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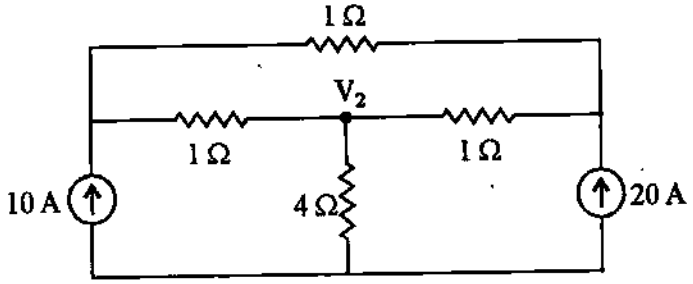
3. Write the answer for any **three** questions from the following questions in **300** words : **3 × 20 = 60**

(A) Find V_2 by the Nodal method for the given circuit. Also find voltage across 10 A & 20 A sources.



(B) With necessary explanation, derive Maxwell's equation in differential and integral forms.

(C) Draw a circuit diagram of Maxwell bridge and derive the equation for determining unknown inductance from Maxwell's inductance bridge and Inductance-capacitance bridge.

(D) Describe the working of single phase fully controlled bridge converter with RL load in Rectification and Inversion mode. Explain with waveforms.

(E) Draw the circuit of a Wein's bridge oscillator and explain it with necessary expressions for the frequency of oscillation.

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