

1(CCE-M)4

ELECTRICAL ENGINEERING - I

[09]

Time Allowed -3 Hours

Maximum Marks-300

INSTRUCTIONS

- i) *Answer must be written in English.*
- ii) *The number of marks carried by each question is indicated at the end of the question.*
- iii) *The answer to each question or part there of should begin on a fresh page.*
- iv) *Your answer should be precise and coherent*
- v) *The part/parts of the same question must be answered together and should not be interposed between answers to other questions.*
- vi) ***Candidates should attempt question Nos. 1 and 5 which are compulsory and any three more out of the remaining questions selecting at least one question from each Section***
- vii) *If you encounter any typographical error, please read it as it appears in the textbook.*
- viii) *Candidates are in their own interest advised to go through the general instructions on the back side of the title page of the answer script for strict adherence.*

- ix) *No continuation sheets shall be provided to any candidate under any circumstances.*
- x) *Candidates shall put a cross(X) on blank pages of answer script.*
- xi) *No blank page be left in between answer to various questions.*
- xii) *No programmable calculator is allowed.*
- xiii) *No stencil(With different markings) is allowed.*

Section - A

1. Answer any three of the following : (75)

- a) State and prove the Millman's theorem.
- b) Explain how the range of an ammeter and voltmeter can be extended. Derive the formula for each case.
- c) What happens to Maxwell's equations under static conditions? Why is that significant?
- d) The denominator polynomial of a transfer function is given by,

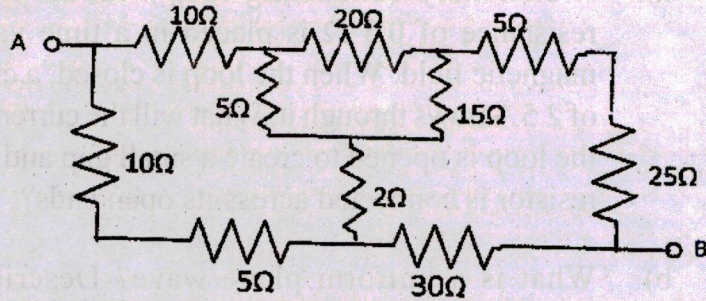
$$Q(s) = S^3 + S^2 + 2s + 24$$

Form the Routh array and verify the stability of the network.

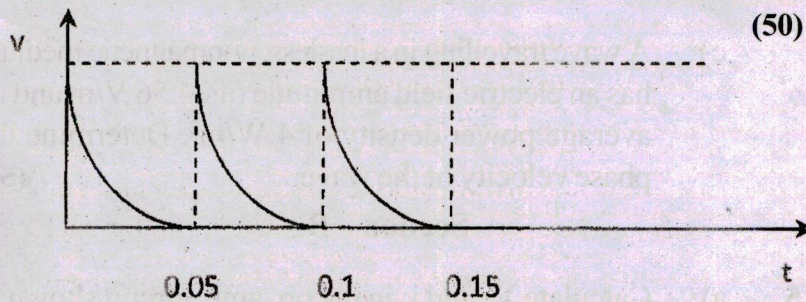
- 2.**
- a) Explain clearly how long distance communication is possible using satellites.
 - b) Determine the resistance between the terminals A & B of the network shown.

09-1

(2)



- c) Determine the average and rms values of the wave shown below, where in the first interval $v = 10 e^{-200t}$. (50)

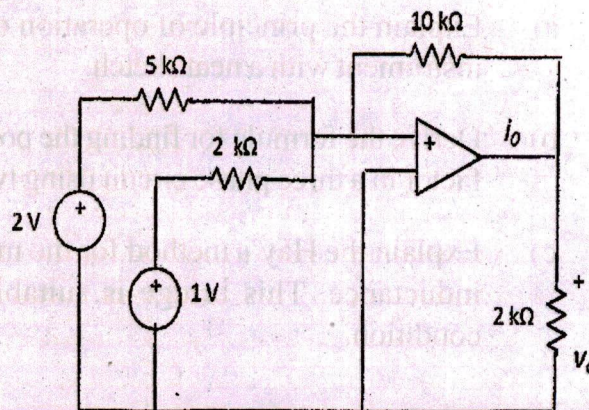


3. a) Explain the principle of operation of moving iron instrument with a neat sketch.
- b) Derive the formula for finding the power and power factor in a three phase circuit using two wattmeters.
- c) Explain the Hay's method for the measurement of inductance. This bridge is suitable under what condition. (50)

4. a) A stationary conducting loop with an internal resistance of 0.5Ω is placed in a time varying magnetic field. When the loop is closed, a current of 2.5 A flows through it. What will the current be if the loop is opened to create a small gap and a 2Ω resistor is connected across its open ends?
- b) What is a uniform plane wave? Describe its properties, both physically and in mathematical terms. Under what conditions is it appropriate to treat a spherical wave as a plane wave?
- c) A wave travelling in a lossless, nonmagnetic medium has an electric field amplitude of 24.56 V/m and an average power density of 4 W/m^2 . Determine the phase velocity of the wave. (50)

Section - B

5. a) Calculate V_o and i_o in the op. amp. circuit shown in Figure.



09-1

(4)

- b) Explain the working of JK Flip Flop Circuit. What is the Race Around Condition. How this condition could be avoided.
- c) Write the conditions that must be satisfied before the parallel operation of the transformer. Which conditions are most essential and which are desirable. (75)
6. a) Draw the basic construction of a p-channel JFET. Apply the proper biasing between drain and source and sketch the depletion region for $V_{GS} = 0$ V.
- b) If an amplifier with gain of -1000 and feedback of $\beta = -0.1$ has a gain change of 20% due to temperature, calculate the change in gain of the feedback amplifier.
- c) Draw the circuit diagram of a mono stable multivibrator. Explain its working also. (50)
7. a) Explain the self excitation process of a dc shunt generator with suitable graph. If a dc shunt generator is not self exciting, what could be the probable causes?
- b) A 240-V, short shunt, cumulative compound generator is rated at 100 A. The shunt field current is 3 A. It has an armature resistance of 50 m Ω , a series field resistance of 10 m Ω , a field diverter resistance of 40 m Ω , and a rotational loss of 2 kW. The generator is supplying the full load at the rated voltage, determine its efficiency.

- c) What happens to the speed torque characteristics of a cumulative compound motor if the series winding is shunted with a field diverter resistance? (50)
8. a) Draw the speed torque characteristics of a three phase induction motor. Mark the stable and unstable regions thereon. How these characteristics behave with an external resistance is inserted in the rotor circuit.
- b) A transformer has its maximum efficiency of 0.98 at 15 kVA at upf. Compare its all day efficiencies for the following load cycles.
- i) Full load of 20 kVA 12 hours/day and no-load rest of the day.
- ii) Full load 4 hours/day and 0.4 full load rest of the day.
- c) Draw properly labelled speed torque characteristics of a three phase induction motor. Mark its stable and unstable regions also. (50)

