Total No. of Questions : **5**   No. of Printed Pages : **11**

M1012012

ELECTRICAL ENGINEERING

### First Paper

Time : 3 Hours]   [Total Marks : 300

Instructions to the candidates :

1.   There are *five* questions in this question paper. *All* the *five* questions have to be answered. Question Nos. **2** to **5** have an internal choice.

2.   The total number of marks is **300** and the time allotted is **3** hours. *All* questions carry equal marks, unless specifically stated.

3.   The first question will be of short answer type consisting of **20** questions, each **one** is to be answered in *one* or *two* lines.

4.   Questions should be answered exactly in order in which they appear in the question paper. Answers to the various parts of the same question should be written together compulsorily and no answers of other questions should be inserted in between them.

5.   Assume suitable data wherever required.

6.   All symbols have their usual meanings.

7.   Give neat sketches or diagrams wherever necessary.

8.   Wherever the word limit has been given, it must be adhered to.

1. Attempt *all* the questions. Each question is of **3** marks : 20×3=60

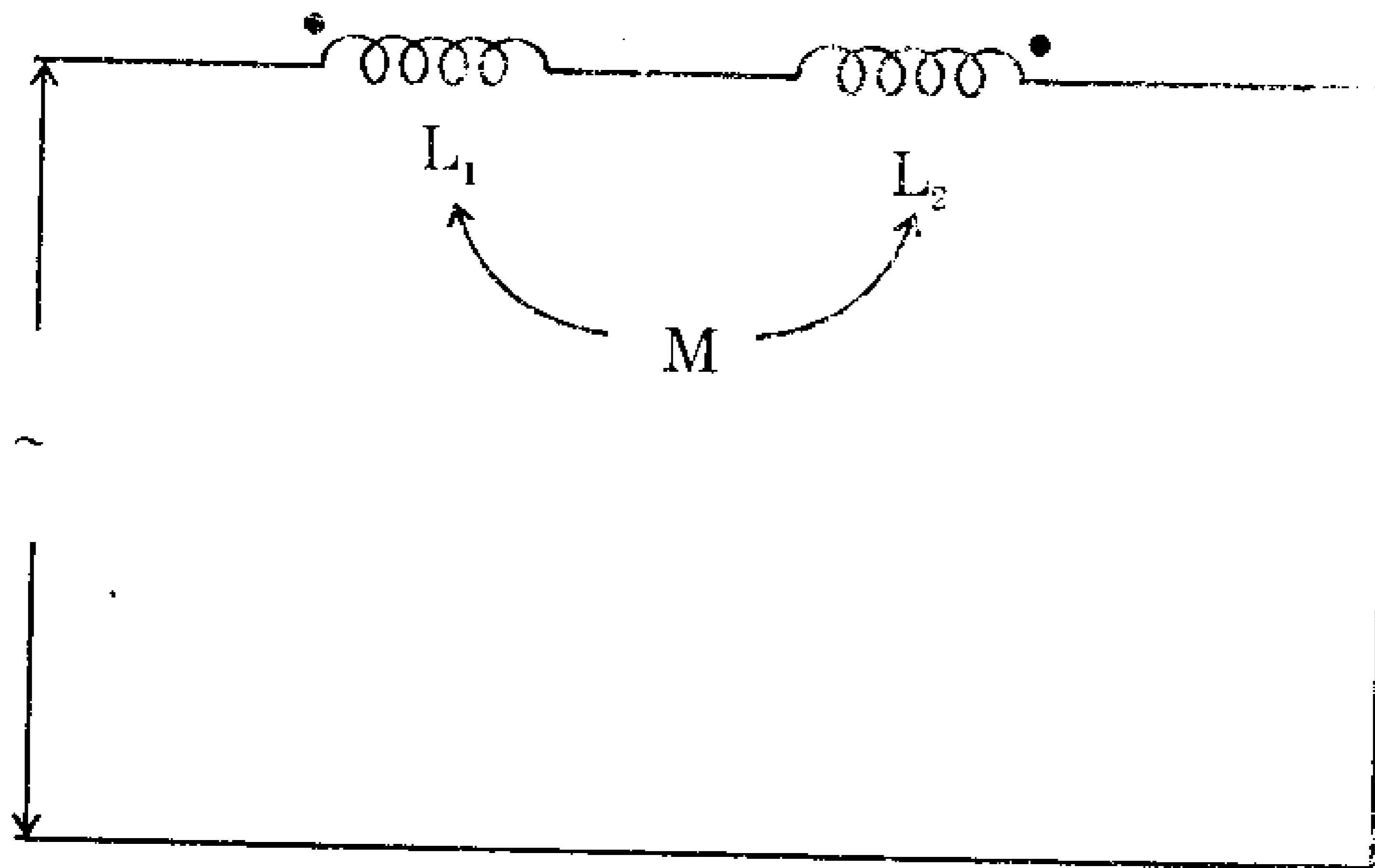(i) Consider the following circuit. "S" is closed at $t = 0$:
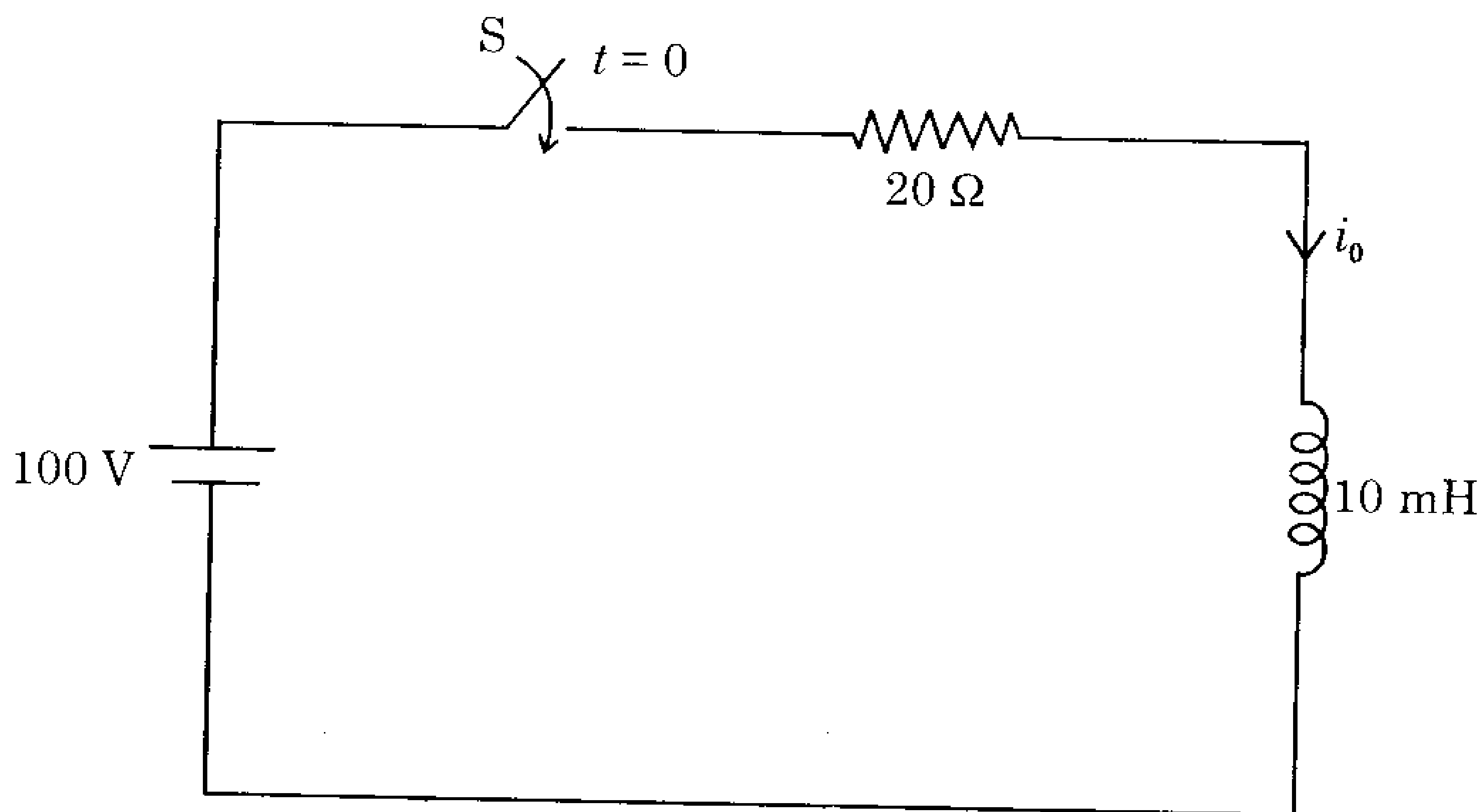
What are the values of i_0 at $t = 0$ and $t = \infty$?

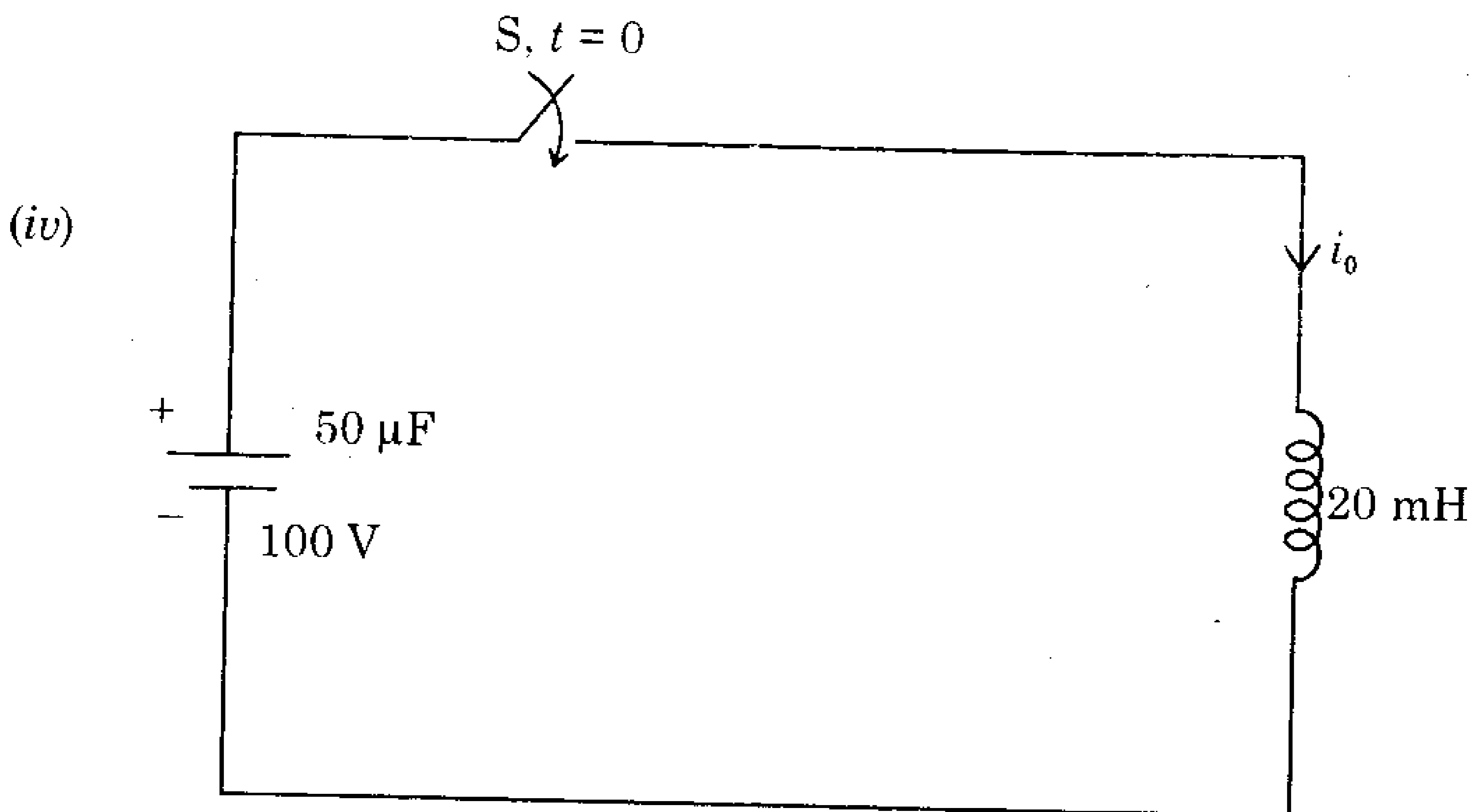(ii) Consider the following circuit. S is closed at $t = 0$:
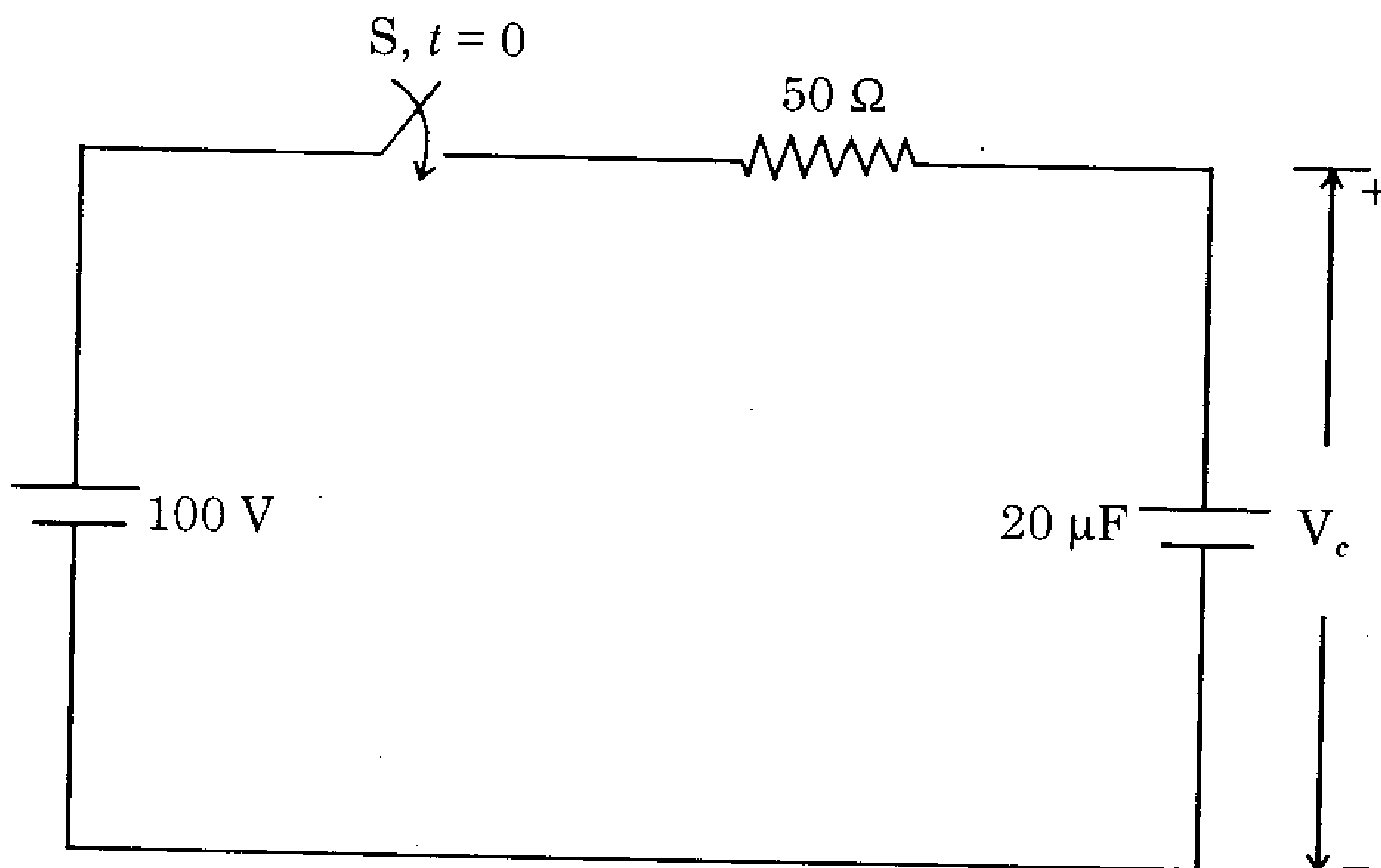
What are the values of V_c at $t = 0$ and $t = \infty$?
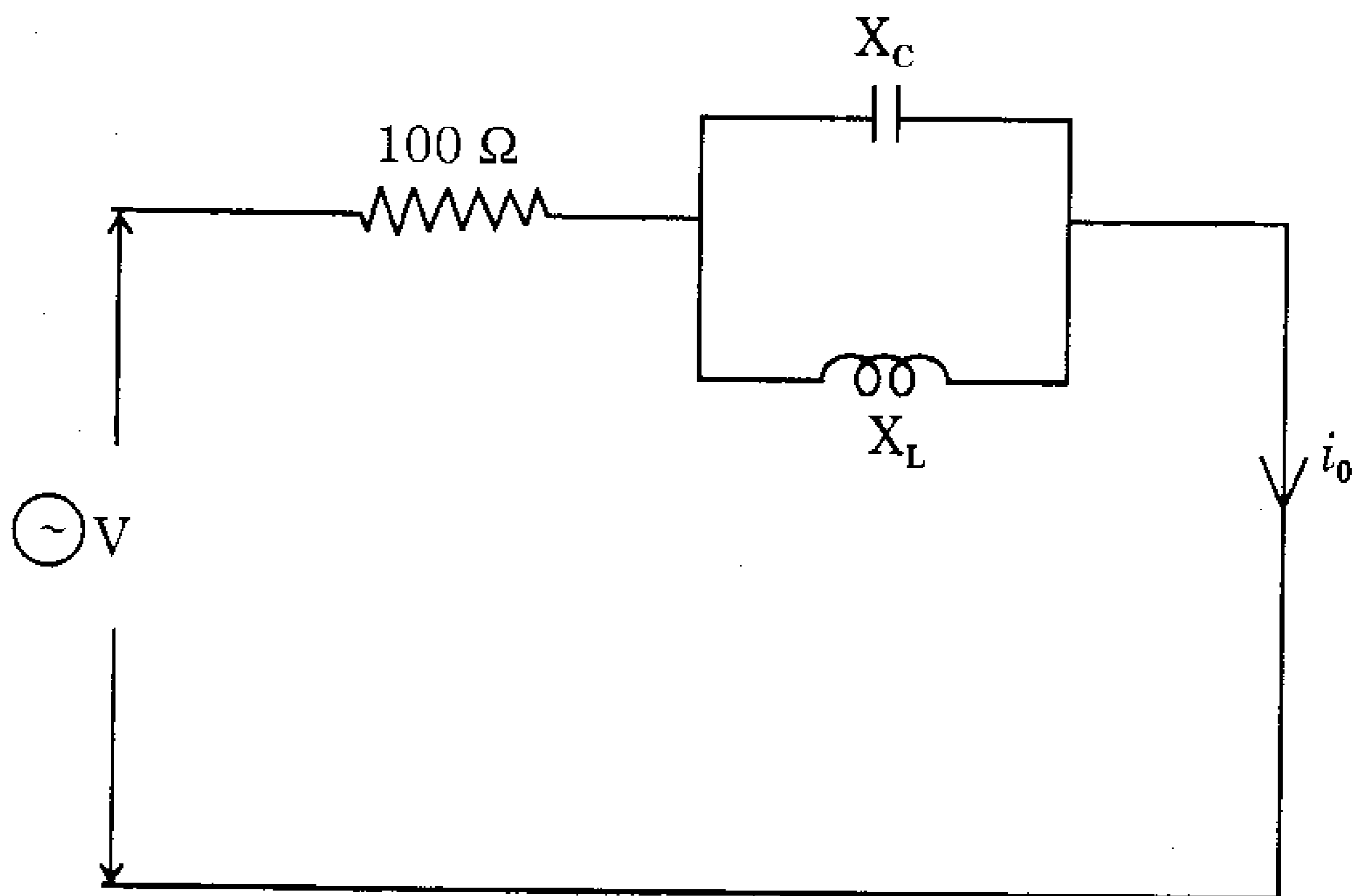
(*iii*) Consider the following circuit :

What is the net inductance "L" of the circuit ?

(*iv*)

The switch is closed at $t = 0$. Write the equation of the current i_0, when the switch is closed at $t = 0$.

(v)   For the stability, what must be the position of the poles in the complex plane ?

(vi)   What is the governing equation of power consumed by the three-phase balanced load in terms of line voltage and line current.

(vii)   Consider the following circuit :

What is the value of i_0 under resonance ? Assume ideal inductance and capacitance.

(*viii*) Consider the following system of parallel plates :
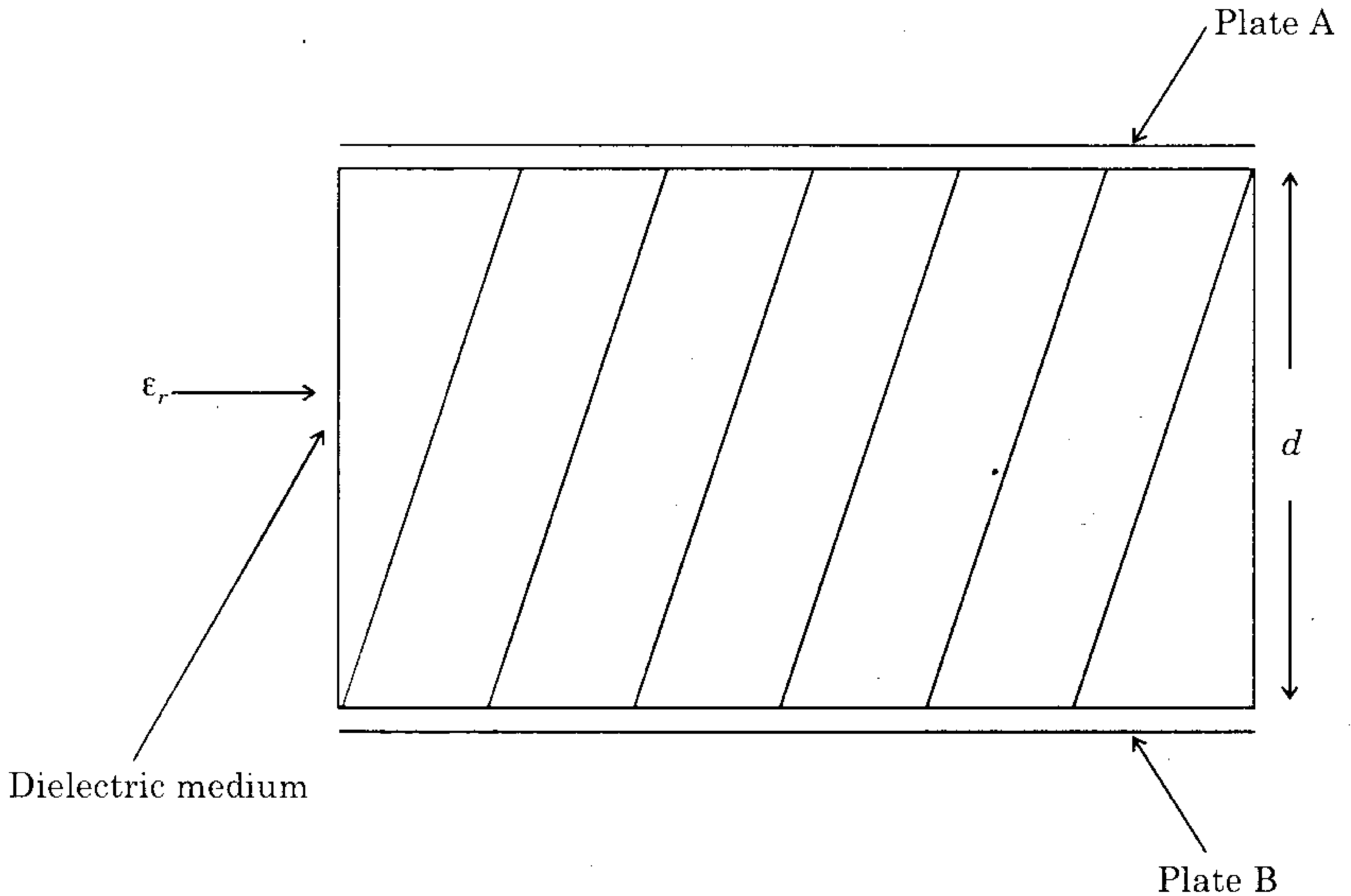
Area of parallel plates is A. Find the equation of capacitane of the capacitor.

(*ix*) Draw the V-I characteristics of a silicon p-n junction diode indicating the cut-in and breakdown voltages.

(x) What are the methods of measurement of low resistance ?

(xi) Mention different types of measurement errors.

(xii) How can the current be measured using a CRO ?

(xiii) What is an active transducer ? Define in 5-6 lines.

(xiv) Which quantity can easily be measured by a LVDT ?

(xv) What is the basic difference between a half wave and full wave rectifiers ?

(xvi) What are the properties of an ideal operational amplifier ?

(xvii) What are the advantages of power electronics based methods over conventional methods for speed control of AC/DC motors ?

(xviii) What are linear time invariant systems ?

(xix) What are the advantages of SMPS over series regulators ?

(xx) Discuss, in brief, about superconductivity.
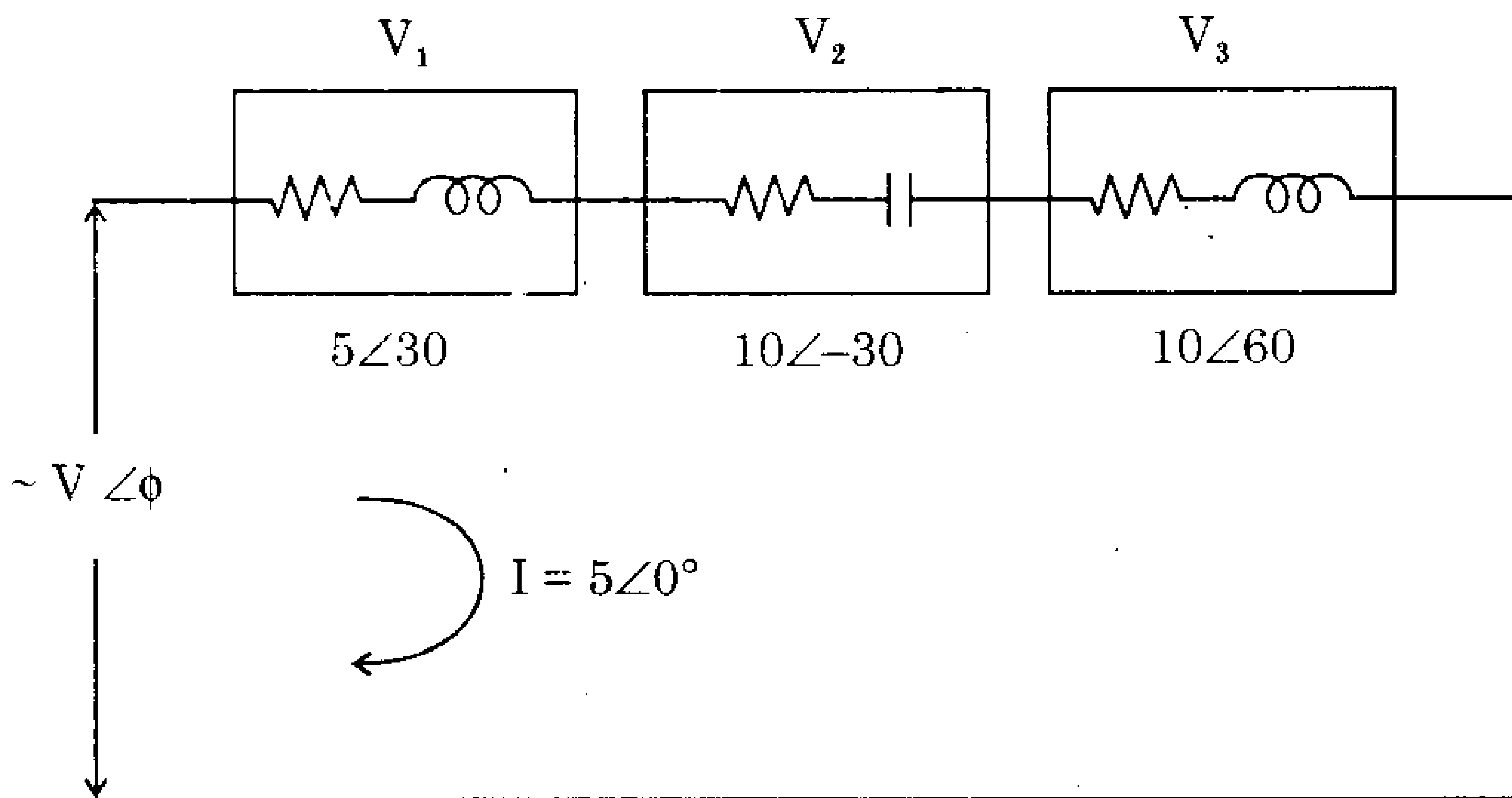
2.   Attempt any *three* questions :

(A)   Define :   20

      (*i*)   Thevenin's theorem

      (*ii*)   Superposition theorem for d.c. circuits

      (*iii*)   Maximum power transfer theorem for a.c. circuits.

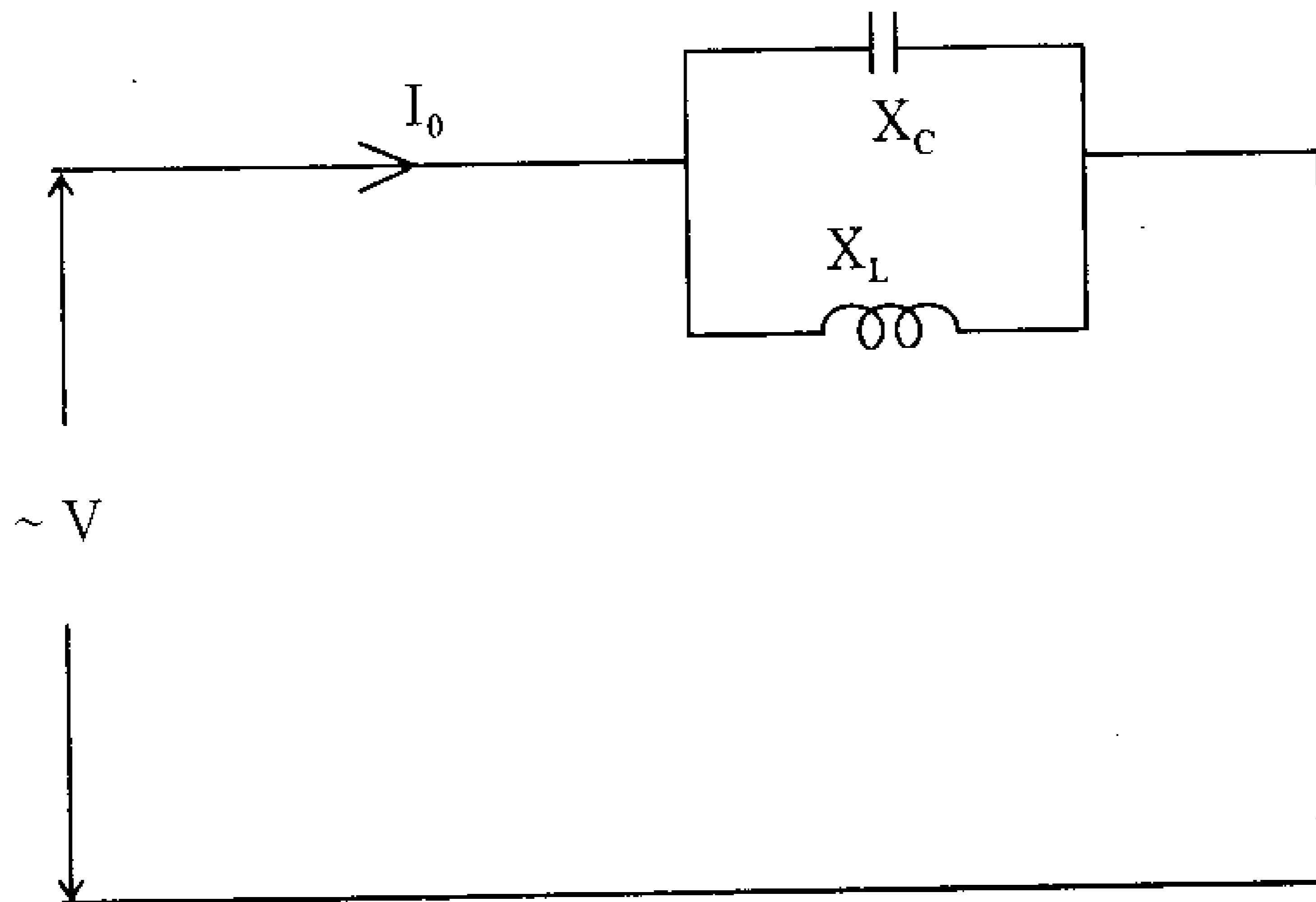   (*iv*)   Reciprocity theorem.

(B)   Consider the following circuit :   20

Circuit current is $I = 5\angle 0$. Calculate V_1, V_2, V_3 and $V\angle\phi$ and draw

phasor diagrams.

(C) Consider the following circuit : 20

Prove that, under resonant condition, current from source, I_0, is zero.

Assume ideal X_C and X_L.

(D) Explain the condition of resonance in series R-L-C circuit. Draw,
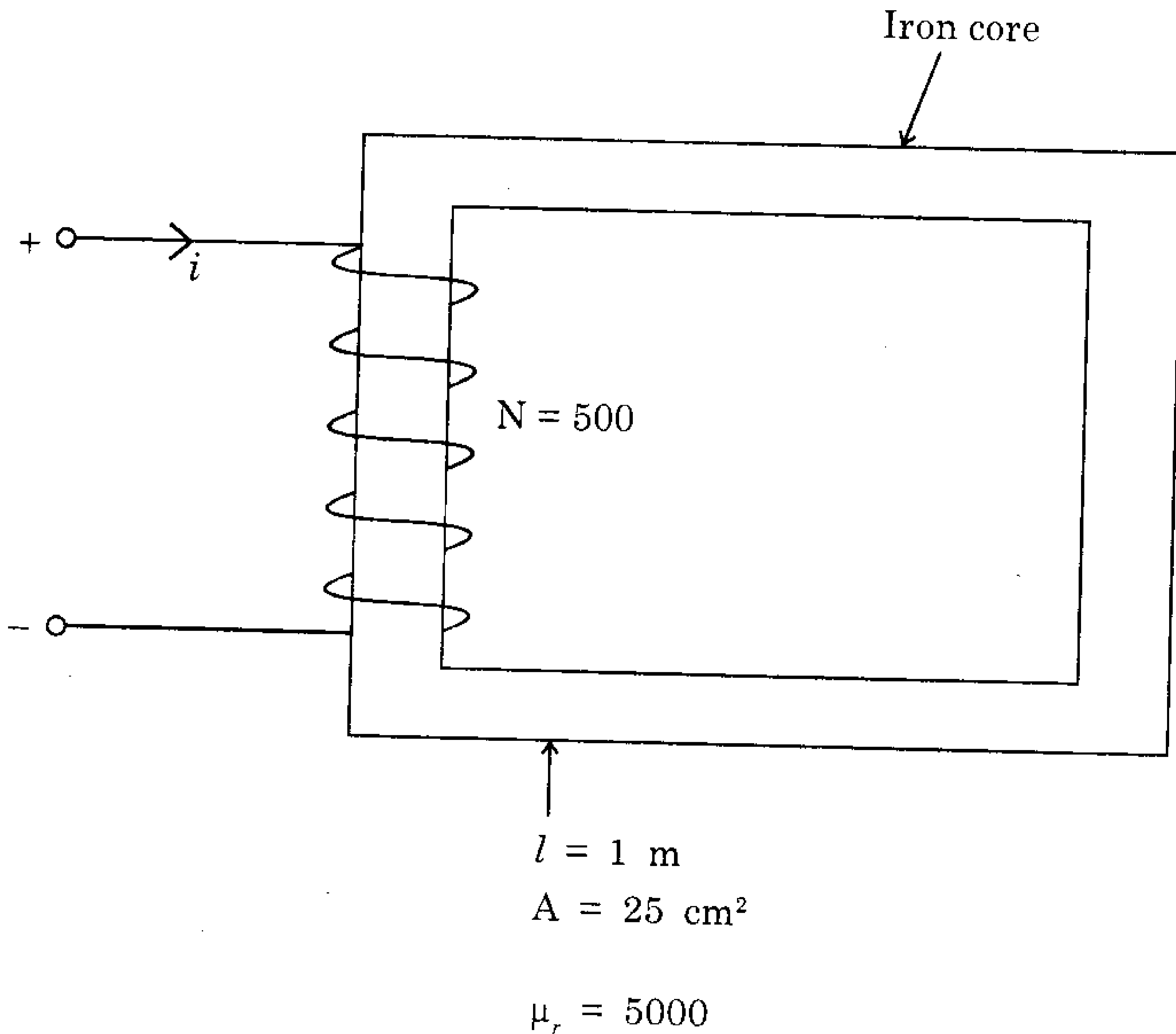
frequency response of this circuit. 20

3. Attempt any *three* parts :

(A) Consider the given electromagnet. It has an iron core of mean length

1 m, cross-section 25 cm² and relative permeability of 5000. The number

of turns of the coil is 500. Find the inductance of the electromagnet

for the circuit shown in the figure below :

20

Iron core

N = 500

l = 1 m

A = 25 cm²

μ_r = 5000

(B) (i) Define Gauss theorem.

(ii) Define divergence theorem.

(iii) Consider a point charge Q. Find the potential and electric field

intensity at a distance r.

5+5+10=20

(C) Consider a system of concentric spheres of radii r_1 and r_2. Outer sphere is grounded. Derive the equation for finding the capacitance of the system. 20

(D) Derive the formula of energy stored in a capacitor having capacitance C, at the prescribed voltage V. 20

4. Answer any *three* questions :

(A) Explain the method of 2-wattmeter method for measurement of power of 3-phase balanced loads. Also prove that reading of one of the wattmeter readings becomes negative for P.F. less than 0.5 (lag). 20

(B) Describe a method of measurement of insulation resistance of cable, using guard ring method. 20

(C) Explain the method of using Lissajous patterns on CRO screen for measurement of frequency and phase angle. 20

(D) Describe the working of LVDT for measurement of linear displacement. 20

5. Attempt any *four* questions. Write the answer in approximately **200** words each :

4×15=60

(A) Write the principle, construction and applications of AC bridges. Explain any *one* in detail.

(B) Describe the construction and principles of operation of moving iron and moving coil type instruments.

(C) Explain the theory of flip-flops and shift-registers.

(D) Explain the theory of different types of systems used in signal analysis.

(E) Explain various controlled converters (single-phase) configurations.

(F) Explain R-2R ladder and successive approximation ADC/DAC circuits.

Total No. of Questions : **5**

No. of Printed Pages : **10**

M1022012

## ELECTRICAL ENGINEERING

Second Paper

Time : 3 Hours]

[Total Marks : 300

Instructions to the candidates :

1. This question paper consists of *five* questions. *All* the questions have to be answered. Each question has an internal choice except Quesiton No. **1.**

2. The Total number of marks is **300** and the time allotted is **3** hours. *All* questions carry equal marks, unless specifically stated.

3. The first question will be of short answer type consisting **20** questions, each **one** is to be answered in *one* or *two* lines.

4. Questions should be answered exactly in order in which they appear in the question paper. Answers to the various parts of the same question should be written together compulsorily and no answers of other questions should be inserted between them.

5. Assume suitable data wherever required.

6. All symbols have their usual meanings.

7. Give neat sketches or diagrams wherever necessary.

8. Wherever word limit has been given it must be adhered to.

9. Use of I.S. codes is permitted.

1. (A) Describe the modification if take off point is shifted from point A to B :

Take off point.
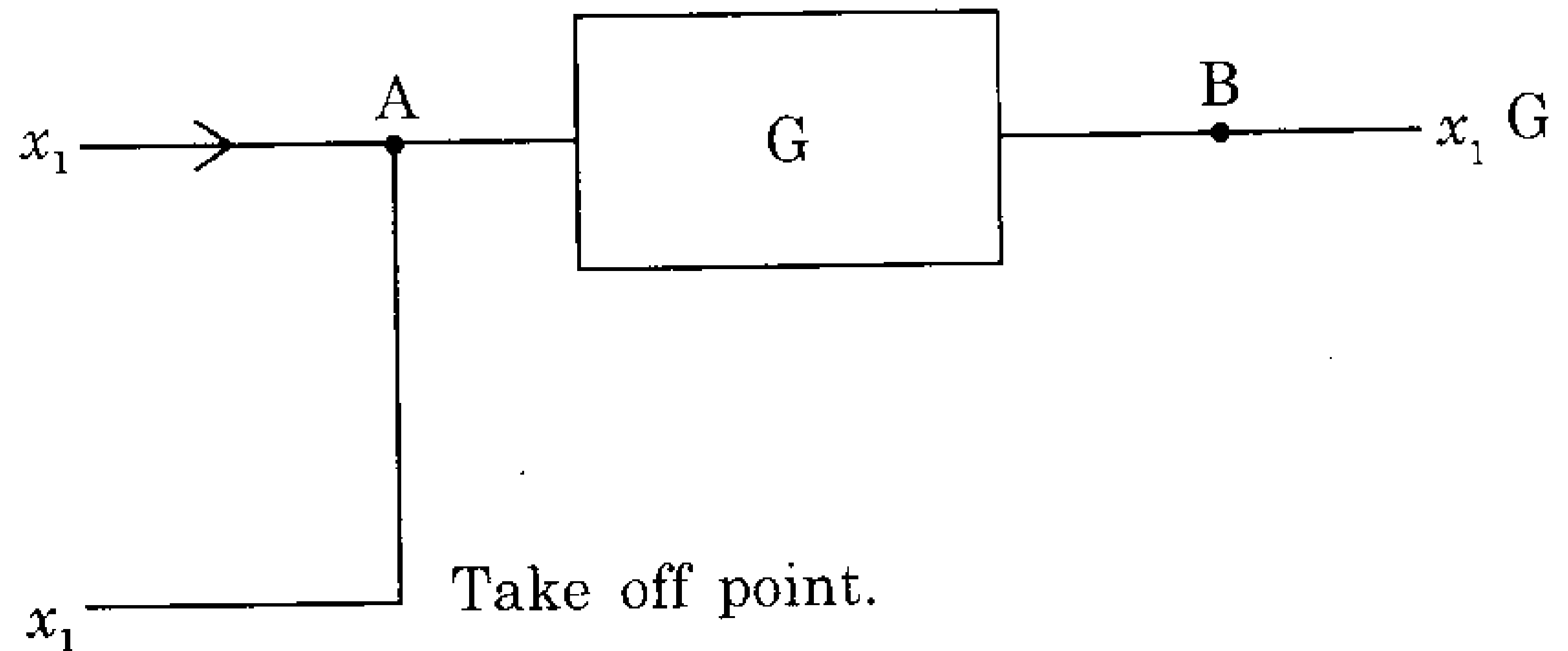
(B) What is the forward path gain in the following graph ?
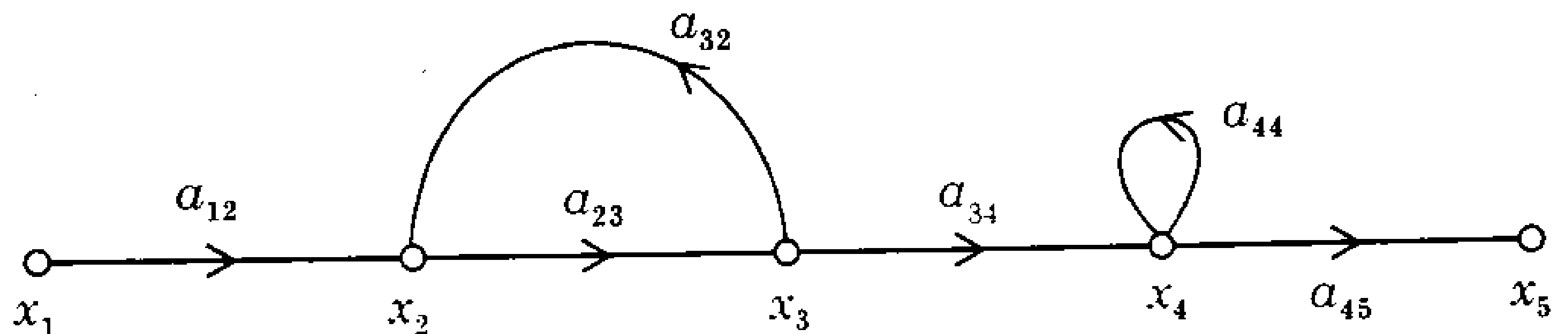
(C) What is the memory size for a 10 bit address line ?

(D) What is the size of address/data bus of 8085 microprocessor ?

(E) Comment on the stability of the following system :

$$T(s) = \frac{(s-2)}{(s+3)(s-4)}.$$

(F)   What is determined by the open and short circuit tests of the transformer ?

(G)   Why is the no load current of the induction motor much more than that of a transformer ?

(H)   Which of the following motors is used in the printers ?

Stepper or Servomotor.

(I)   What are the applications of synchronous motor ?

(J)   Can a d.c. series motor run at no load ?

(K)   What is the surge and intrinsic impedances of a transmission line ?

(L)   What are the methods of power factor improvement ?

(M)   If p.u. impedance of 230/115 V, 2300 VA transformer is 0.05, then what is the value of short circuit current at full load ?

(N)   What is the Ferranti effect ?

(O)   Draw the R-X diagrams of a mho relay.

(P)   Which antenna system is suitable for microwave communication ?

(Q)   What is the Gunn effect ?

(R)   A stationary CW radar transmits at 5 GHz frequency. Calculate the doppler frequency seen by it when the target has a radial velocity of 100 km/hr.

(S)   Explain flicker. How is this problem overcome in T.V. system ?

(T)   What is the coherent and non-coherent detection schemes in carrier system ?

2.   (A)   (i)   Reduce the following block diagram :   20
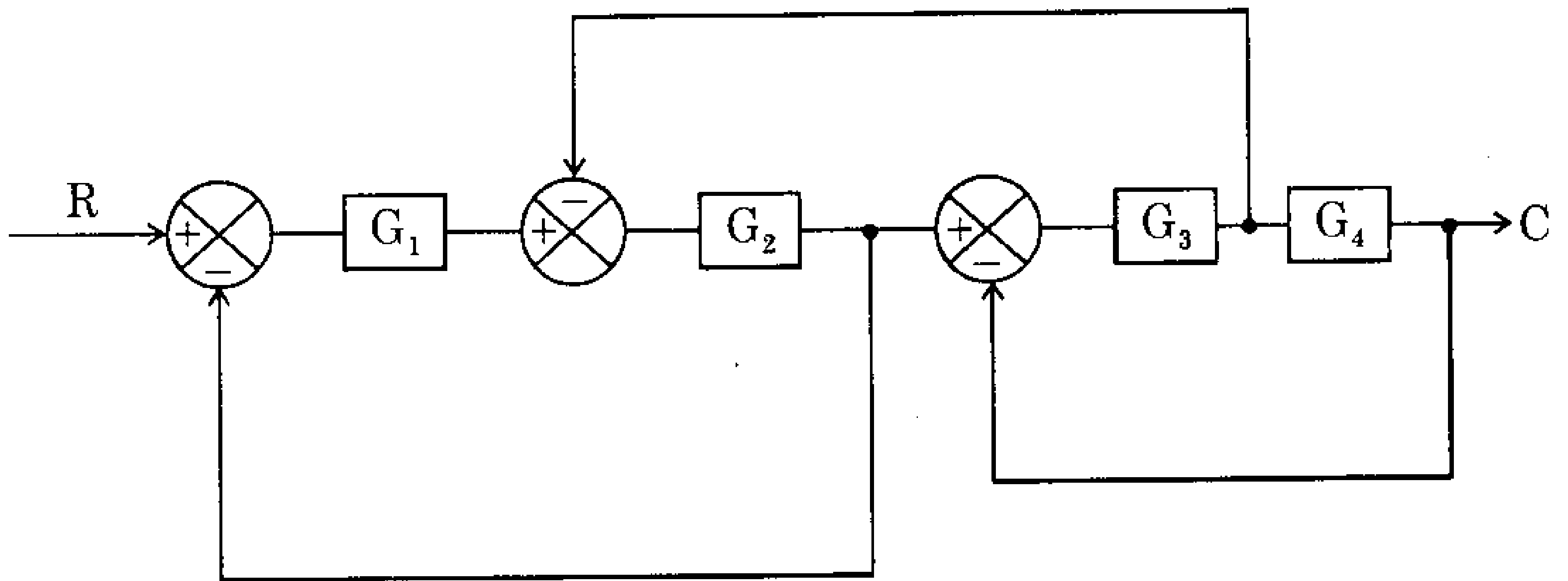
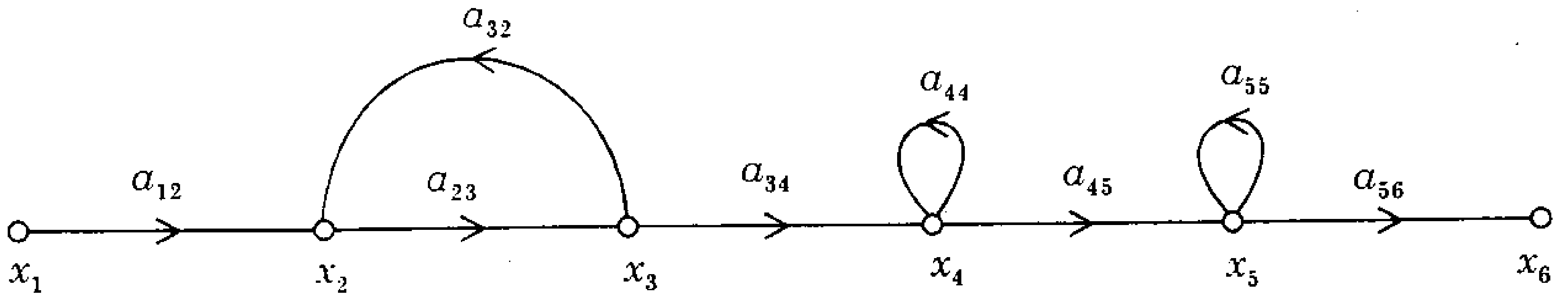(ii)   Explain the working of a Ward Leonard method for speed control of a d.c. motor.   20

(iii) Open loop transfer function of feedback system is as given below :   20

$$G(s)H(s) = \frac{k(s + 1)(s + 3)(s + 6)}{s(s + 4)(s + 8)}$$

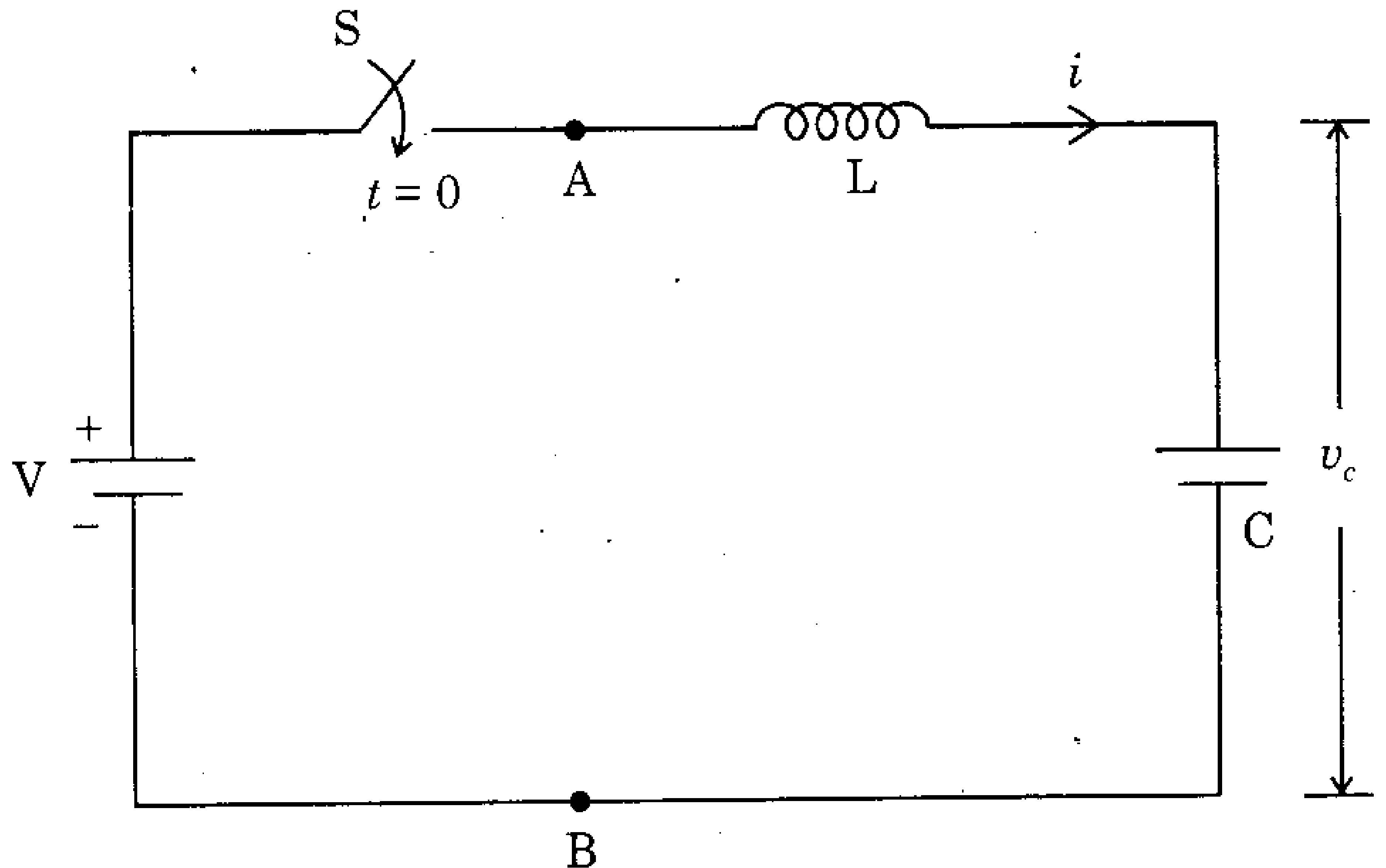Plot the root locus, as K is varied from 0 to ∞.

Or

(B)   (*i*)   Find the gain of the following signal flow graph :   20

(*ii*)   Explain the principle of self excitation of a shunt generator.   20

(*iii*)   Find the plot of voltage across the capacitor as a function of time, when switch is closed at $t = 0$:   20

3. (A) (i) A d.c. shunt motor is being operated from 300 V mains. Its no-load speed is 1200 rpm. When fully loaded, it delivers a torque of 400 Nm and its speed drops to 1100 rpm. Find its speed and power outputs, when delivering the same torque if operated with an armature voltage of 600 V. Excitation is assumed to be constant, i.e. motor field is still excited at 300 V. State any assumption that are required to be made. 20

(ii) Explain the method of determining the equivalent circuit of a single phase transformer by OC and SC tests. 20

(iii) Open and short circuit tests of a 3 phase, 400 V, 50 Hz, 20 kVA synchronous generator delivers the following data : 20

$$I_f = 2 \text{ A}$$

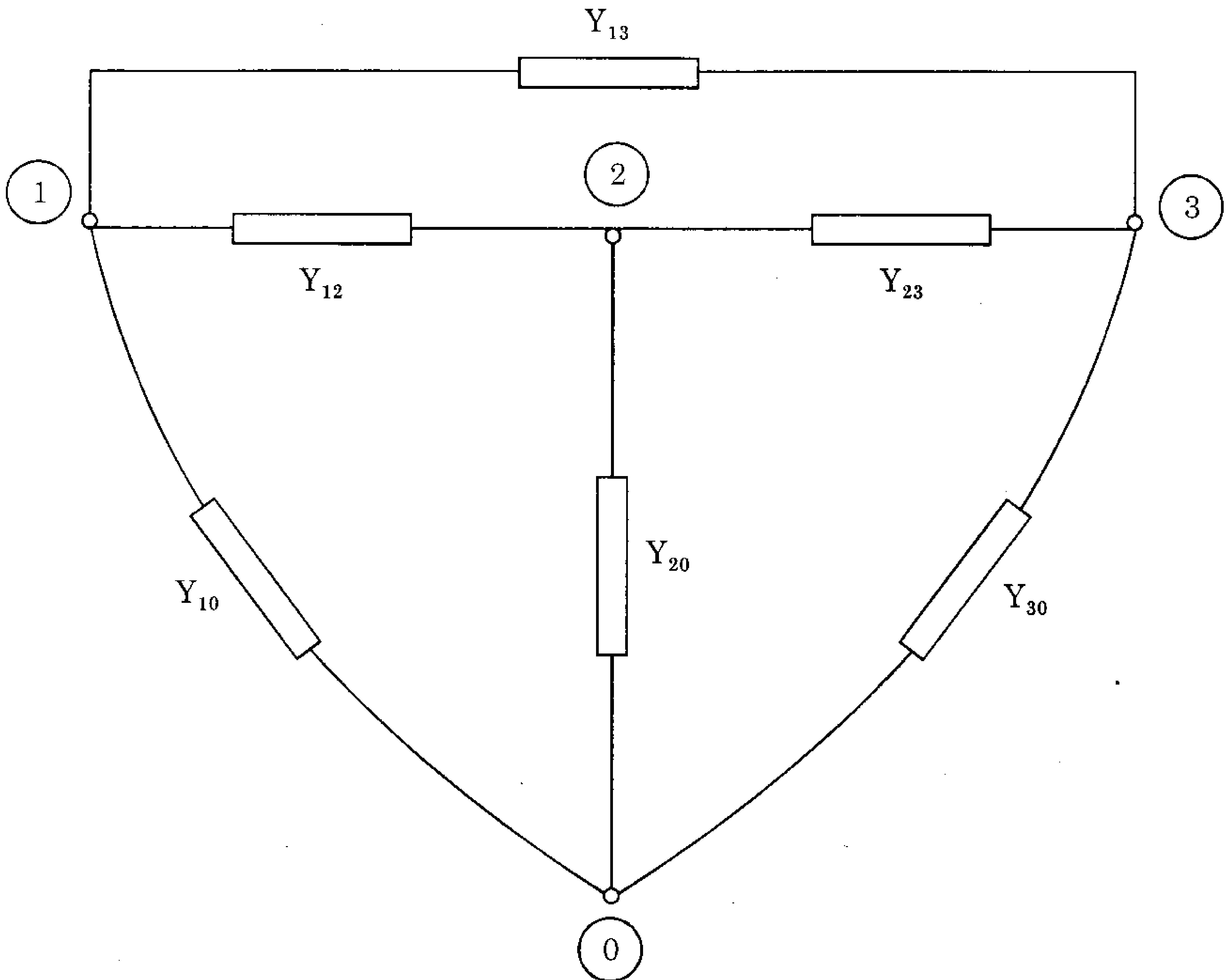$$E_0 \text{ (per phase)} = 50 \text{ V}$$

$$I_f = 2 \text{ A}$$

$$ISC = 20 \text{ A}$$

Find regulation of the generator when generator is delivering 20 kVA at 400 V and 0.8 p.f. (lagging). Assume $R_a = 1\Omega$.

Or

(B)   (*i*)   Determine the bus admittance matrix of the following

network :   20

(Reference Node)

(ii) Draw the phasor diagram and equivalent circuit of a 3-phase induction motor. Also deduce the torque equation.   20

(iii) Explain the working of non-circulating current mode for a single phase dual convertor fed d.c. drive.   20

4.   (A)   (i)   Explain PALD system with block diagram. And also state its merits and demerits.   20

(ii) Explain TWT. What is the use of an attenuator ? Explain the use of helix structure. What is a slow wave structure ?   20

(iii) Write short notes on the following :   20

     (1)   Linear block codes

     (2)   Convolution codes.

Or

(B)   (i)   What is the delta modulation ? Explain its advantages and disadvantages with its applications.   20

(ii)   Explain with a neat diagram, the modulation and demodulation techniques for frequency control.   20

(iii)   Explain :   20

      (a)   Carrier to noise ratio in satellite link design

      (b)   Concept of characteristic impedance.

5.   (A)   (i)   Describe the basic principles of TDM and FDM techniques. 20

    (ii)   What is the optical feedback ? Explain threshold condition for laser oscillations.   20

    (iii) For a (6, 3) code generator, matrix G is :   20

$$G = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 \end{bmatrix}$$
$$\underbrace{\hphantom{1\ 0\ 0}}_{I_c} \quad \underbrace{\hphantom{1\ 0\ 1}}_{P}$$

For all possible data words, find the corresponding code words and verify that this code is single error correcting code.

Or

(B) (i) Explain the working of CW Doppler radar with block diagram. 20

(ii) What is the effect of earth's magnetic field and collision in sky wave propagation ? 20

(iii) Explain the concept of bandwidth, beam-width and polarization in an antenna. 20