Roll No.

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Total No. of Questions : **5** No. of Printed Pages : **8**

M1012010

ELECTRICAL ENGINEERING

First Paper

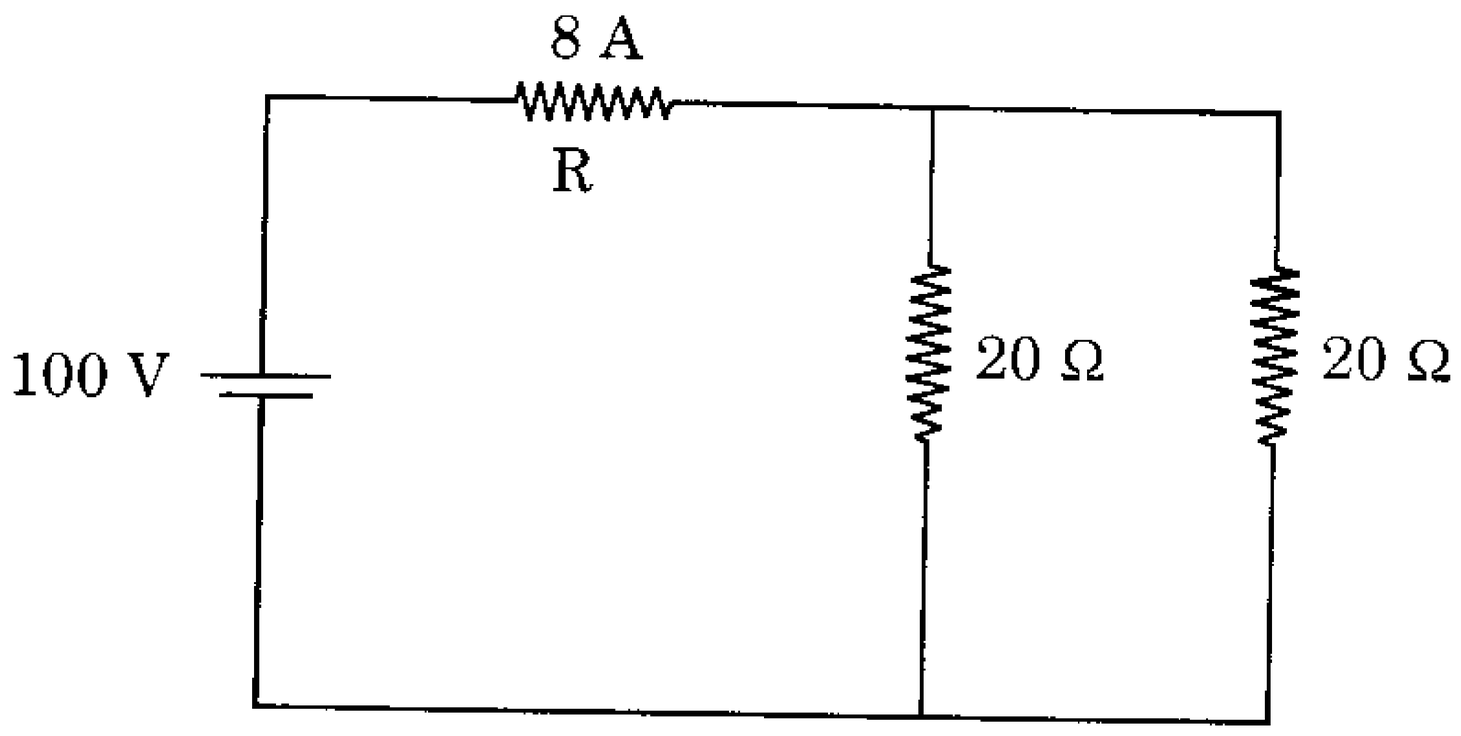
Time : 3 Hours] [Total Marks : 300

Instructions to the candidates :

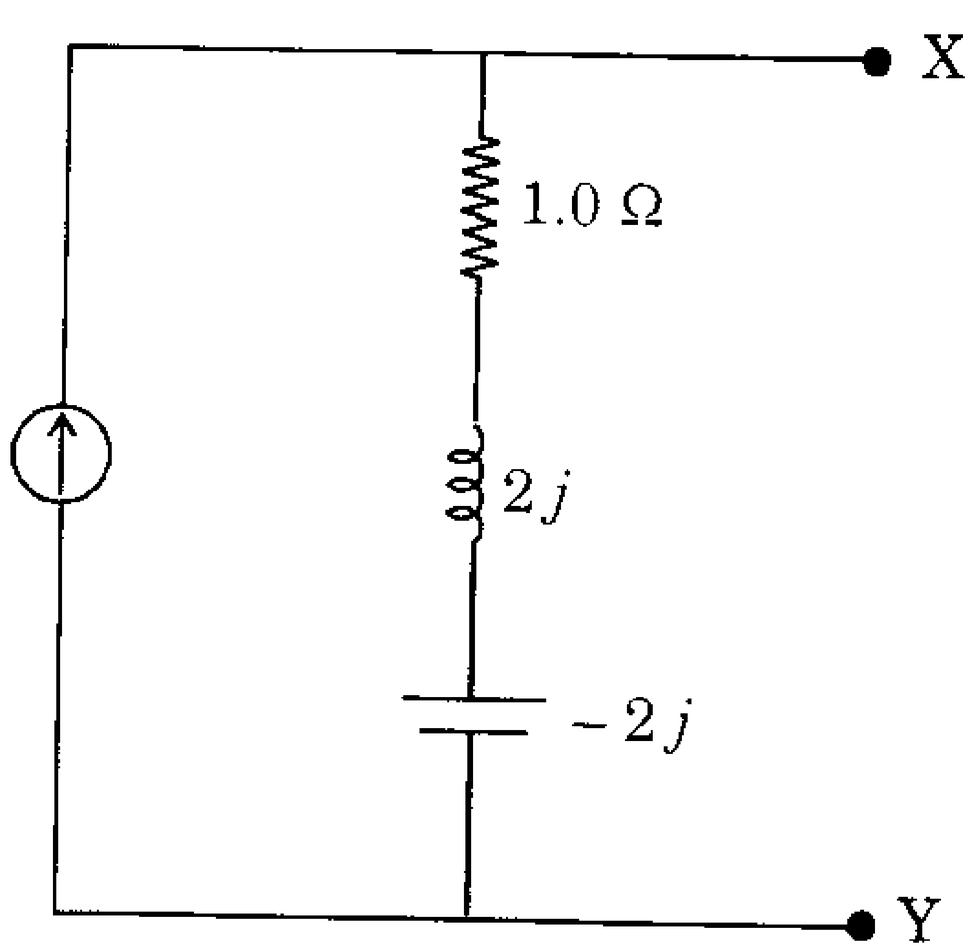
1. This question paper consists of *five* questions. *All* the questions have to be answered. Question Nos. **2** to **5** have an internal choice.
2. The Total number of marks is **300** and the time allotted is **3** hours. *All* questions carry equal marks, unless specifically stated.
3. The first question will be of short answer type consisting **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.

1. Answer *all* questions from A to T :

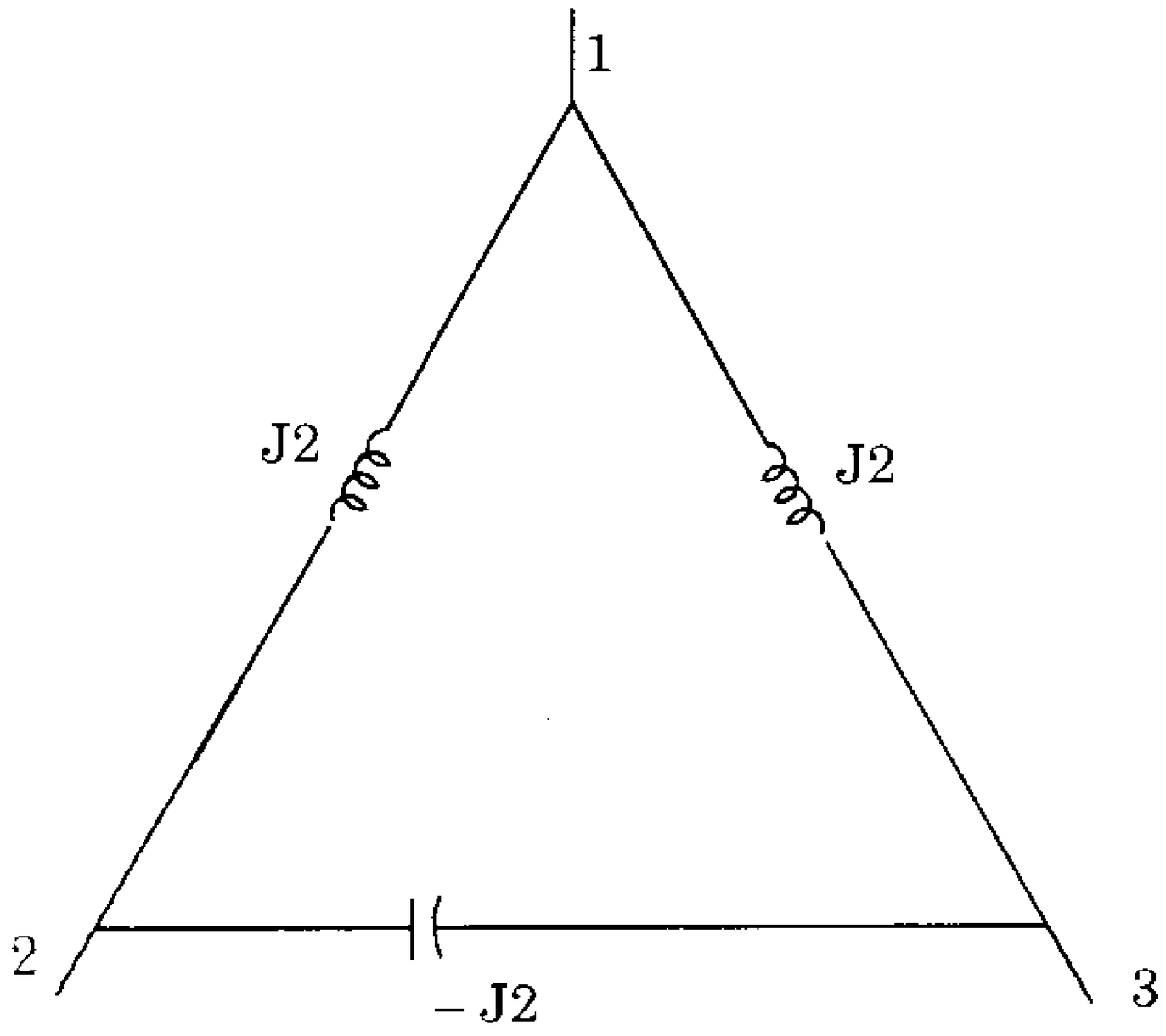
(A) In the figure shown below, find the value of R. 3



(B) In the figure shown below, the current source has a value of 1 $\angle 0$ A and R = 1.0 Ω, the impedance $Z_l = 2j\ \Omega$ and $Z_c = -2j\ \Omega$. Find the Thevenin's equivalent looking into the terminal XY. 3



(C) Find the Y equivalent of the given Δ circuit show below : 3



(D) A metal sphere with 1.0 m radius and a surface charge of 10 Coulomb/m^2 is enclosed in a cube of 10 m side. Find the total outwards flux normal to the surface of the cube. 3

(E) A TEM wave is incident normally upon a perfect conductor, find the relation between (E and H) fields at the boundary. 3

(F) What will happen when a voltage is applied to an intrinsic semiconductor at room temperature ? 3

(G) A D.C. voltmeter has a sensitivity of 2000 Ω/volt. What is the current through the voltmeter when it measures half full scale in 100 V range ? 3

(H) What will happen to the output voltage of a balanced Wheatstone bridge, when resistance in each arm is doubled ? 3

(I) A 10 bit ADC is used to convert analog signal into digital in the range of..... . 3

(J) What are the specifications of a filter ? 3

(K) Two non-inverting amplifiers having gains of 1 and 10 respectively are made using identical OPAMPS. If bandwidth of unity gain amplifier is 'X', what is the bandwidth of amplifier with gain 10 ? 3

(L) What are the drawbacks of collector to base biasing of a transistor ? 3

(M) Realise Ex-OR operation using NAND Gates. 3

(N) What are vectored interrupts ? Write their functions with their priorities. 3

(O) Classify the chopper circuits with their various quadrant operations. 3

(P) What are the various methods of commutation of SCR ? 3

(Q) What are the various types of convertors used for the speed control of an A.C. motor ? 3

(R) Name at least *four* properties of Z-transforms. 3

(S) Find out the current through the capacitor at $t = 0^+$ if the Laplace Transform of the voltage across the capacitor with 0.5 F is given by

$$V_c(s) = \frac{(s + 1)}{s^3 + s^2 + s + 1}.$$ 3

(T) What are the types of terms used in the Trigonometric Fourier Series of a Periodic time functions ? 3

2. Answer any *one* part (A) *or* (B) :

(A) (*i*) State and explain the Superposition Theorem. 10

(*ii*) Define r.m.s. and average value of a sinusoidal wave form. Given the current value as $i = \text{Im} \sin \omega t$. find out the rms, average value and prove that the form factor is 1.1. 20

(*iii*) A coil having a resistance of 4 Ω and an inductance of 1 H is connected in parallel with a circuit comprising a similar coil in series with a capacitor C and a non-inductive resistor R. Calculate the values of C and R so that the currents in either branch of the arrangement are equal but differ in phase by 90°. Frequency is given as 50 Hz. 30

Or

(B) (*i*) Find the relationship between electric field intensity and potential, hence find the Poisson's equation and Laplace's equation. 30

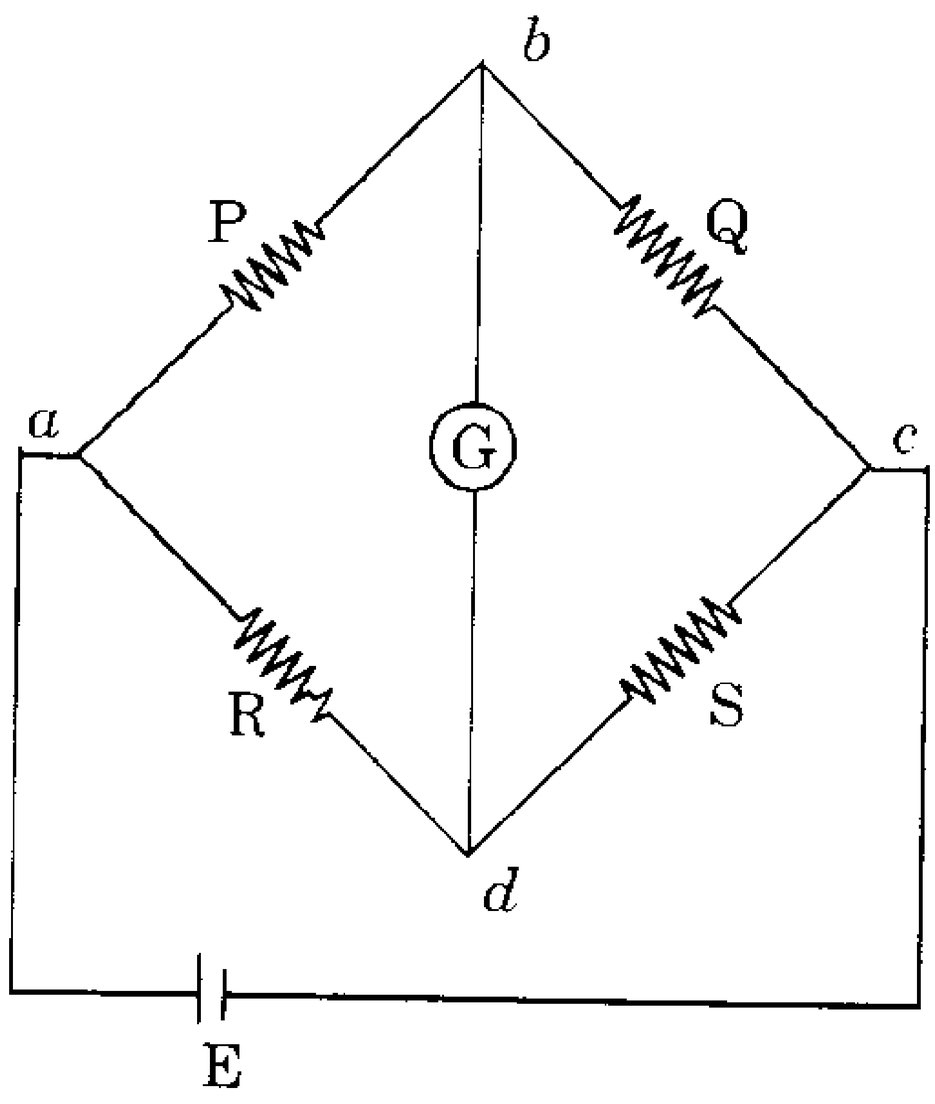
(*ii*) Define *n*-type material. *p*-type material, Intrinsic material. Extrinsic materials. and Depletion region. 10

(*iii*) A cast steel electromagnet has an airgap of length 2 mm and an iron path of length 30 cm. Find the number of ampere turns necessary to produce a flux density of 0.8 W*b*/m^2 in the gap. Neglect leakage and fringing. 20

3. Answer any *one* part A or B :

(A) (*i*) What are the various types of errors introduced in measurement ? Classify and explain. 30

(*ii*) A Wheatstone bridge shown below, with the values of resistances as P = 1 kΩ, R = 1 kΩ, S = 5 kΩ, G = 100 Ω. The Thevenin source generator voltage E_0 = 24 mV and the galvanometer current is 13.6 μA. Calculate the value of Q. 30



Or

(B) (*i*) What are various types of Practical OP-AMP circuit ? Draw their various configurations with relevant explanation. 45

(*ii*) Find the successive approximation ADC output for a 4-bit converter to a 3.217 V input, if the reference is 5 V. 15

4. Answer any *one* part (A) or (B) :

(A) (*i*) What are various types of three phase converter circuits ? Draw and explain the three-pulse converter to find out the output voltage, current and impedance. 30

(*ii*) What are various operating modes of 8255 PPI ? Draw and explain the pin diagram of the Intel 8255A. 30

Or

(B) (*i*) What is a Laplace Transform ? How is it performed ? Find out the Laplace transform of the derivative and an integral form of time. 30

(*ii*) The system described by the difference equation $y(n) - 2y(n-1) + y(n-2) = x(n) - x(n-1)$ has $y(n) = 0$ and $n < 0$. If $x(n) = \delta(n)$, then find $y(2)$. 30

5. Write short notes on any *four* : 15×4

(*i*) MOSFET;

(*ii*) Flip-Flop;

(*iii*) Resonant frequency meter (Ferro-dynamic type);

(*iv*) Clipper and clamper circuits;

(*v*) Transducers;

(*vi*) Resonance in RLC series circuit.

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Total No. of Questions : **5**

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M1022010

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.
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1. Attempt *all* parts in this question : 20×3=60

(A) What is the purpose of GM and PM in control systems ?

(B) Explain the utility of Del and Laplacian Operators in EM field theory and Communication.

(C) Explain the maximum power transfer theorem.

(D) Why M.I. type instruments are preferred over PMMC instruments ?

(E) The control actions in control systems can improve steady state errors of transient response or both, justify.

(F) Enlist all the interrupts available in 8085 processor as per their priorities.

(G) Why stepper motors and SRM based drives are preferred in modern applications ?

(H) FACTS in power systems in modern times is a necessary requirement, explain.

(I) High signal to noise ratio is desirable in instrumentation and analog communication.

(J) PCM (pulse code modulation) in Digital Communication is a well accepted modulation technique.

(K) Fibre optic communication is preferred in wide area networks.

(L) Why microwave antennas are preferred over Yagi antennas ?

(M) Autoreclosure of circuit breakers is an essential operation in clearing faults.

(N) Bandwidth is an essential Parameter for Analog and Digital Communication.

(O) DC series motors are preferred for traction applications.

(P) Starters (3 point and 4 point) are preferred for DC motor applications.

(Q) Cycloconverters and Dual converters occupy a special place in drive applications.

(R) Voltage stability and angle stability are special problems in power system studies.

(S) Autotransforms are preferred over normal transformers.

(T) IDMT relays are recommended for power system protection.

2. Attempt part (A) *or* part (B) : 60

(A) (*a*) State Routh Hurwitz criteria for stability and discuss special cases of R–H criterion.

(*b*) Find state transition matrix for Non-homogeneous case.

(*c*) Given

$$G(s)H(s) = \frac{10(s + 1)}{s(s + 3)(s + 2)},$$

obtain the error constants K_p, K_v and K_a, and error estimations for unit step, ramp and parabolic inputs. Draw the pole-zero plot for $G(s)\ H(s)$.

Or

(B) (*a*) For Fig. 1

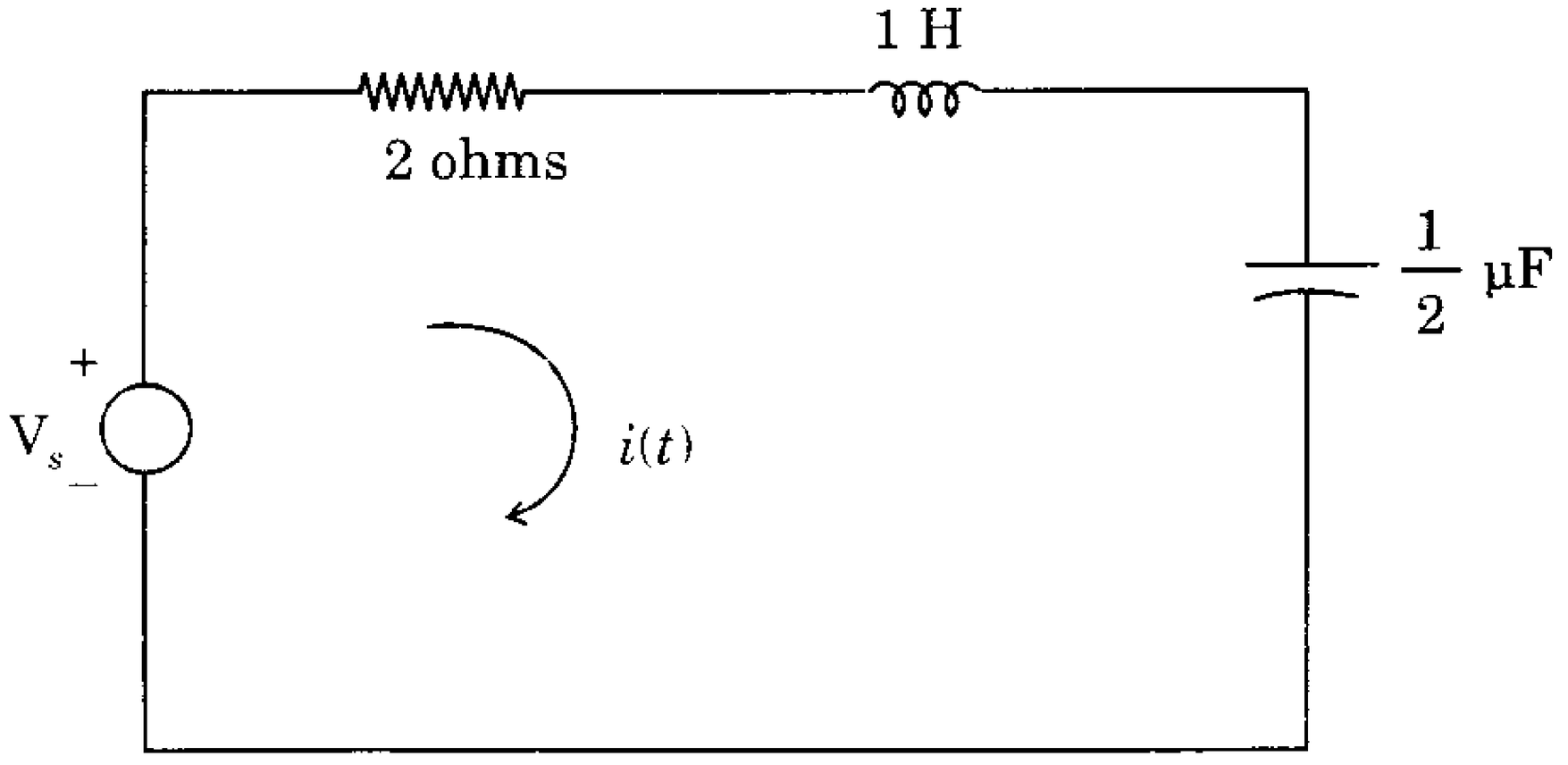

Fig. 1

The series RLC circuit is to be scaled by $k = 200$ and $k_\infty = 10^4$. Determine the new element values.

(*b*) Draw the programmers model of 8085 microprocessor.

(*c*) In four quadrant operation, draw torque-slip characteristics of Polyphase Induction motor.

3. Attempt part A or part B : 60

(A) (*i*) What are the different methods for speed control of d.c. shunt motor ? Explain with mathematical relations.

(*ii*) Explain the various static VAR compensation techniques in Power System applications.

(*iii*) For a system, given :

$|X| = 2.0$ P.u

$|E| = 210$ V

$|V| = 180$ V

Find the expressions for active and reactive powers in terms of load angle δ. For what value of δ, the power would be maximum ? Derive any formula used.

Or

(B) (*i*) Derive a general expressions for emf and torque equations in rotating machines.

(*ii*) Draw the approximate equivalent circuit of a transformer as referred to primary side. Use any approximation as desired.

(*iii*) The current rating of a relay is 5 Amps.

PSM = 1.5,

TMS = 0.3,

CT ratio 500/5.

Fault Current = 5000 A.

Determine the operating time of the relay at TMS = 1.0, operating time at several PSM is :

PSM	**Oper. Time** (in secs.)
2	10
4	5
5	4
8	3
10	2.8
20	2.4

4. Attempt part (A) or part (B) : 60

(A) (*i*) Why state space approach is preferred for continuous time and discrete time systems ?

(*ii*) What is meant by linear convolution and why convolution codes are required in digital communication. Explain using mathematical relations.

(*iii*) Explain polarization propagation and bandwidth requirements for antennas and wave propagation.

Or

(B) (*i*) Explain the block diagram of fibre optic communication link and explain the meanings of absorption and emission of light.

(*ii*) Describe the various keying schemes used in Digital communication.

(*iii*) Discuss DMA controller and its role in data transfer.

5. Write short notes on any *four* in about **200** words each : 15×4=60

(*a*) Role of Mason's gain formula in deriving transfer function of a system.

(*b*) Discuss interrupts of 8085 citing an example (program).

(*c*) Explain rotating magnetic field development in single phase and 3-phse induction motors.

(*d*) Differentiate between dielectric and induction heating.

(*e*) Explain the procedure for analyzing symmetrical and un-symmetrical faults in power systems.

(*f*) Explain the various types of Radar based systems and their principles of operation.