Total No. of Questions—12] [Total No. of Printed Pages—7

DEC-2008

[3462]-145

S.E. (E & TC) (First Semester) EXAMINATION, 2008

SIGNALS AND SYSTEMS

(2003 COURSE)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Determine whether the following signals are periodic; if they are periodic, find the fundamental period :

(*i*) $x(t) = \cos^2(2\pi t)$

(*ii*) $x[n] = (-1)^n$ [8]

(*b*) Sketch the waveforms of the following signals : [10]

(*i*) $x(t) = u(t + 1) - 2u(t) - 2u(t - 1)$

(*ii*) $y(t) = r(t + 1) - r(t) + r(t - 2)$.

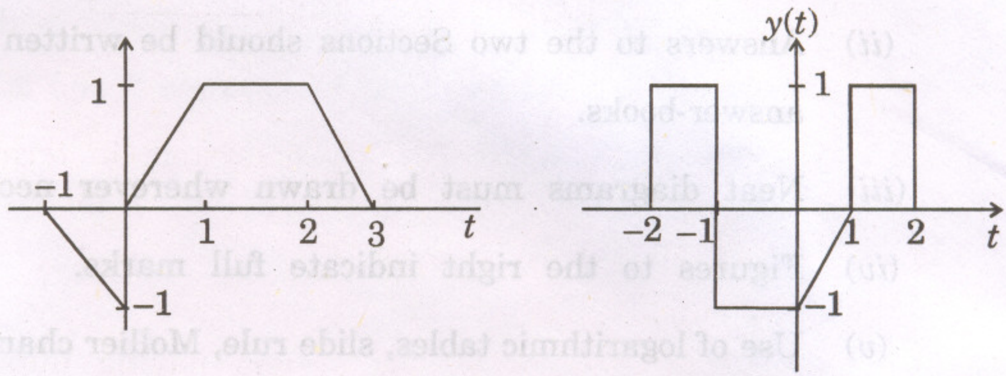
Or

2\. (*a*) The systems that follow have input $x(t)$ or $x[n]$ and output $y(t)$ or $y[n]$. For each system determine whether it is (I) memoryless (II) stable (III) causal (IV) linear (V) time invariant. [10]

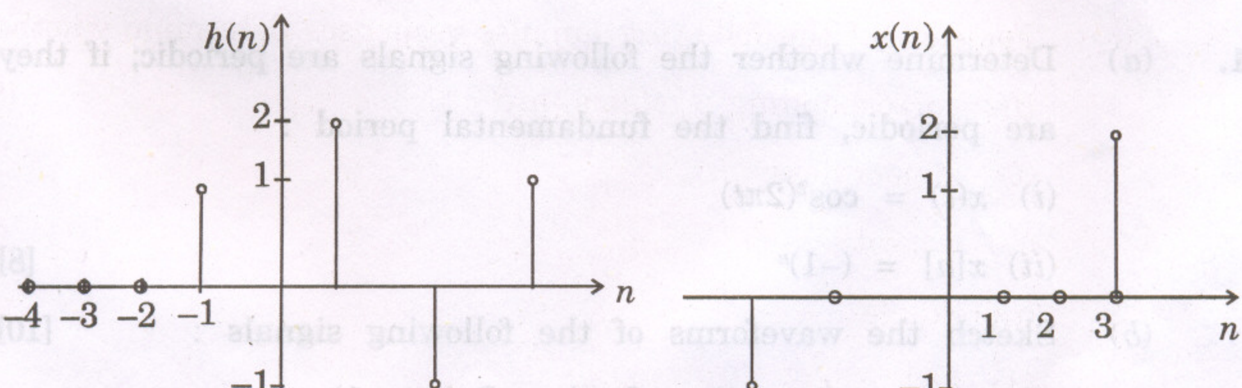
(*i*) $y[n] = 2x[n]\ u[n]$

(*ii*) $y(t) = x(2 - t)$.

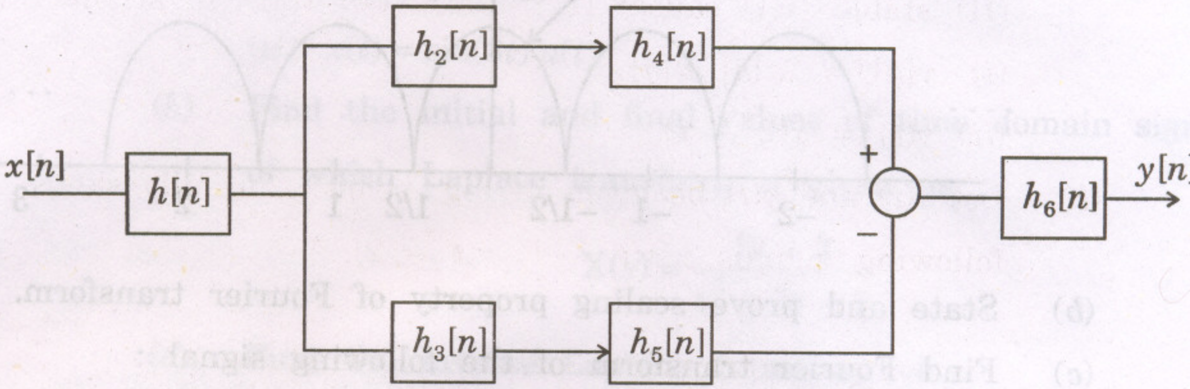
(*b*) Let $x(t)$ and $y(t)$ be given in Fig. below. Carefully sketch the following signals : $x(t + 1)\ y(t - 2)$. [8]



3\. (*a*) Evaluate the following discrete time convolution : [8]



(*b*) Find the expression for the impulse response relating the input $x[n]$ to output $y[n]$ in terms of the impulse response of each subsystem for LTI system. [4]



(*c*) Derive expression for stability of system in terms of impulse response. [4]

Or

4. (*a*) Find step response of the system having impulse response $h[n] = \delta[n] - \delta[n-2]$. [5]

(*b*) What is the application of convolution and correlation in signals and systems ? [3]

(*c*) For each of the following impulse responses determine whether the corresponding systems are : [8]

(*i*) Memoryless

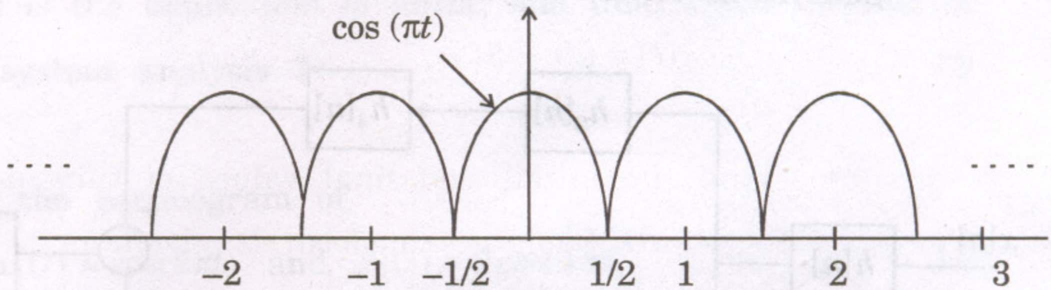
(*ii*) Causal

(*iii*) Stable

(1) $h[t] = e^{-2t} u(t-1)$

(2) $h[n] = 2u[n] - 2u[n-5]$

5. (*a*) Find the Fourier series coefficients of full wave rectified cosine waveform shown in the following Fig. [8]



(*b*) State and prove scaling property of Fourier transform. [4]

(*c*) Find Fourier transform of the following signal :

$$x(t) = \frac{d}{dt}\left(2t\, e^{-2t}\, u(t)\right).$$ [4]

(*d*) What are the limitations of Fourier transform over Laplace transform ? [2]

Or

6. (*a*) Use integration property to find inverse Fourier transform of

$$X(j\omega) = \frac{1}{j\omega(j\omega + 1)} + \pi\delta(\omega).$$ [6]

(*b*) Find the Fourier representation of the following time domain signal :

$$x(t) = e^{-2t}u(t-3).$$ [4]

(*c*) Determine frequency response and impulse response for the system described by the following differential equation. Assume zero initial condition :

$$\frac{d}{dt}(y(t)) + 3y(t) = x(t).$$ [8]

SECTION II

7. (*a*) Determine Laplace transform and ROC of the following signals : [8]

(*i*) $x(t) = u(t-5)$

(*ii*) $x(t) = \sin(3t)\,u(t)$

(*b*) Find the initial and final values of time domain signal $x(t)$ of which Laplace transform is given as : [4]

$$X(s) = \frac{2s+3}{s^2+5s+6}.$$

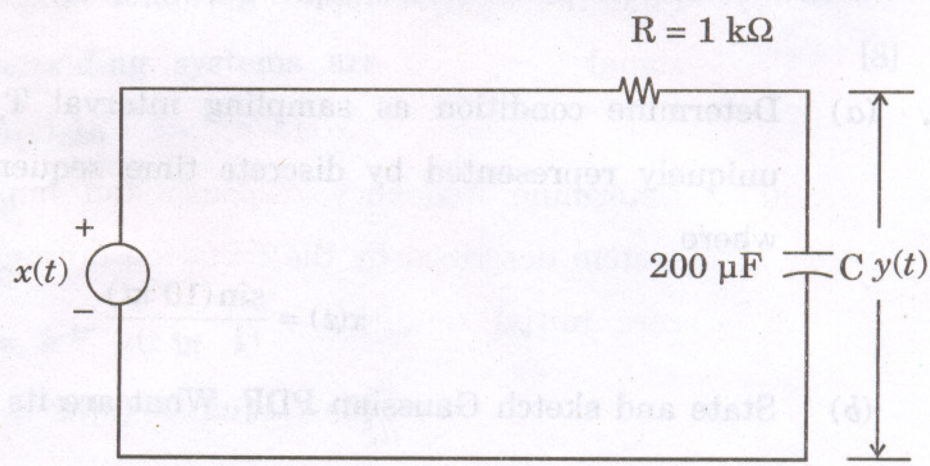
(*c*) Find the inverse Laplace transform of

$$X(s) = \frac{3s+2}{s^2+4s+5}.$$ [4]

(*d*) Explain the significance of region of convergence for Laplace transform. [2]

Or

8. (*a*) Use Laplace transform to find the voltage across capacitor $y(t)$ for the RC circuit shown in the figure below. In response to applied voltage $x(t) = \frac{3}{5}e^{-2t}u(t)$ and initial condition $y(0^-) = 2$. [8]



(*b*) State and prove convolution and differentiation property of Laplace transform. [8]

(*c*) What is the application of initial and final value theorem in LTI system analysis ? [2]

9. (*a*) Find the correlogram of

$$x_1(t) = \cos(2\pi t) \text{ and } x_2(t) = 2\cos(4\pi t).$$ [4]

(*b*) State the properties of autocorrelation and sketch the autocorrelation of sine bursts. [8]

(*c*) Define energy spectral density and power spectral density functions. What is their application ? [4]

Or

10. (*a*) State and prove the relation between autocorrelation and ESD. [6]

(*b*) Find ESD of the following energy signal :

$$x(t) = e^{-100t}u(t).$$ [4]

(*c*) Find autocorrelation of the following discrete time signal :

$$x[n] = \{\underset{\uparrow}{1}, 2, 1\}.$$ [4]

(*d*) State Parseval's energy theorem. [2]

11. (*a*) Determine condition as sampling interval T_s so that $x(t)$ is uniquely represented by discrete time sequence $x(n] = x[nT_s]$ where

$$x(t) = \frac{\sin(10\pi t)}{\pi t}.$$ [4]

(*b*) State and sketch Gaussian PDF. What are its applications ? [4]

(*c*) With example explain the concept of continuous and discrete time random variable. What is PDF and distribution function (CDF) of tossing a dice experiment ? [8]

Or

12. (*a*) Find the mean and variance of uniform PDF. [6]

(*b*) What are the properties of mean and variance ? [6]

(*c*) In a certain city the number of power outages per month is a random variable having Gaussian PDF with $\mu = 10$ (mean) and standard deviation $\sigma = 2.5$. What is the probability that number of outages will be between 5 and 20 ? erf (4) = 0.4999 erf (2) = 0.477. [4]

Total No. of Questions—12] [Total No. of Printed Pages—8+1

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S.E. (Elex. & E.&TC) (First Sem.) EXAMINATION, 2008

SEMICONDUCTOR DEVICE AND CIRCUIT

(2003 COURSE)

Time : Three Hours **Maximum Marks : 100**

N.B. :— (*i*) Answers to the two Sections should be written in separate answer-books.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of electronic pocket calculator is allowed.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) State and explain law of mass action. [4]

(*b*) Define :

(*i*) Drift current

(*ii*) Diffusion current

(*iii*) Mobility. [6]

(*c*) Determine the conductivity and resistivity of an intrinsic sample of silicon at normal room temperature (i.e. 300 K). Assume electron mobility μ_n = 1350 cm²/(V-sec); hole mobility μ_p = 480 cm²/(V/sec), intrinsic concentration at 300 K = 1.52×10^{10} and charge of an electron or hole = 1.6×10^{-19} coulomb. [8]

Or

2. (*a*) An N-type semiconductor has a resistivity of 20×10^{-2} ohm-m. The mobility of the electrons through a separate experiment

P.T.O.

was found to be 100×10^{-4} m^2 $V^{-1}S^{-1}$. Find the number of electron carriers per m^3. [6]

(*b*) Explain features and application of GaAs semiconductor material. [6]

(*c*) Define a graded semiconductor. Explain why an electric field must exist in a graded semiconductor. Derive required expression. [6]

3. (*a*) An ideal germanium diode at a temperature of 120°C has a reverse saturation current of 30 μA at a temperature of 120°C. Find the dynamic resistance for a 0.2 V bias in (*i*) The forward direction, (*ii*) Reverse direction. [6]

(*b*) A series circuit consist of a forward biased diode and two resistors 330 Ω and 470 Ω as shown in Fig. 1. Find the value of current through the circuit. Assume diode to be real diode. [4]

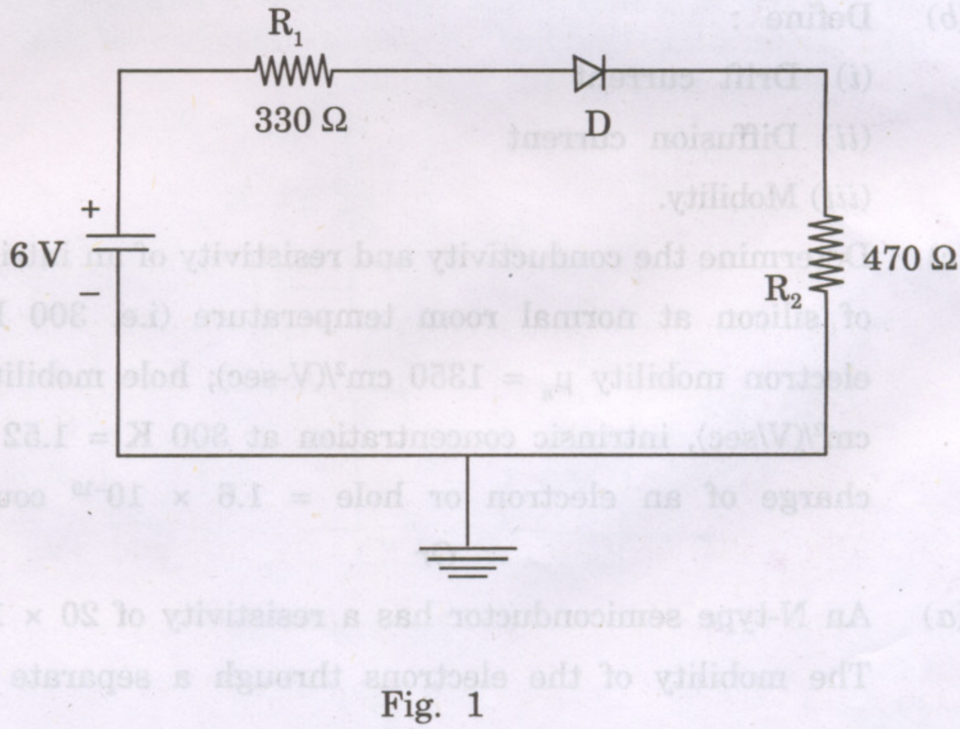

Fig. 1

(*c*) Briefly explain the behaviour of junction in forward bias and reverse bias mode for PN diode and draw its volt-ampere characteristics. [6]

Or

4. (*a*) Explain construction and working of Tunnel diode and V-I characteristics for the same. State its applications. [6]

(*b*) What is a Zener diode ? Draw the equivalent circuit of an ideal Zener in the breakdown region. [6]

(*c*) A 6.2 V Zener diode has a resistance of 20 Ω. What is the terminal voltage when the current is 25 mA ? [4]

5. (*a*) Define :

(*i*) DC drain resistance (RD)

(*ii*) AC drain resistance (rd)

(*iii*) Transconductance (gm)

(*iv*) Amplification factor (μ)

(*v*) The pinch-off voltage

(*vi*) Channel ohmic region

(*vii*) I_{DSS}

(*viii*) I_{GSS}. [8]

(*b*) The JFET operating with I_D = 12 mA and $|V_{DS}|$ = 6 V. If $|V_P|$ = 3 V and I_{DSS} = 20 mA. [8]

Specify the values of V_{GS}, V_{SS}, R_S and RG for Fig. 2

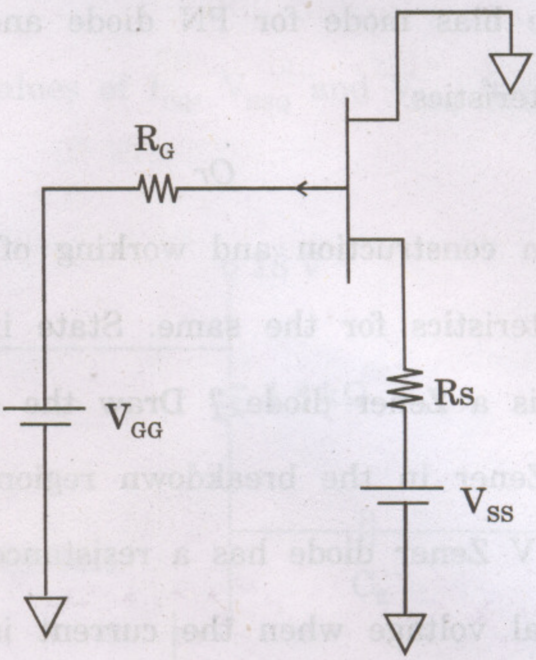

Fig. 2

Or

6. (*a*) Determine the following for the network shown in Fig. 3 (*i*) V_D, (*ii*) V_S, (*iii*) V_{DS}, (*iv*) V_{DG}, (*v*) I_D and V_{GS}. [8]

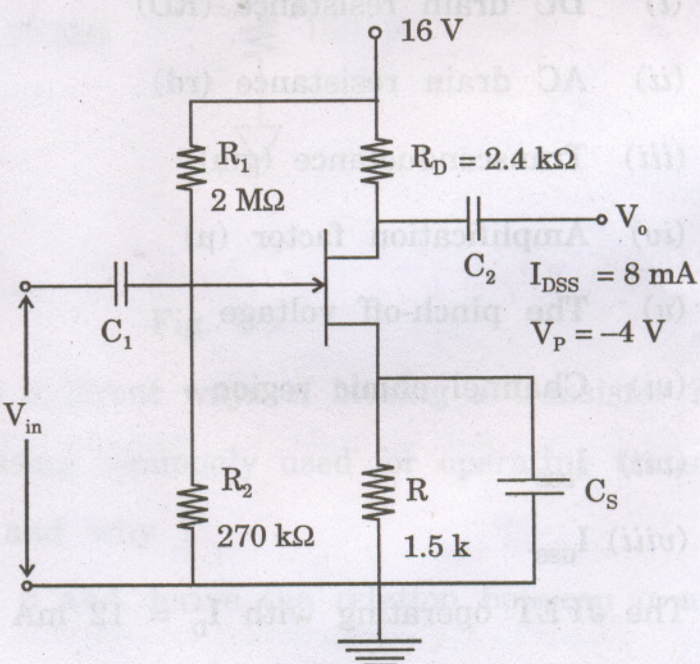

Fig. 3

(b) What is meant by thermal runway ? Why thermal runway will not occur in JFET ? [4]

(c) Compare JFET and BJT. [4]

SECTION II

7. (a) Draw construction of E-MOSFET and explain drain and transfer curve. [8]

(b) Determine I_{DQ} and V_{DSQ} for E-MOSFET shown in Fig. 4. [6]

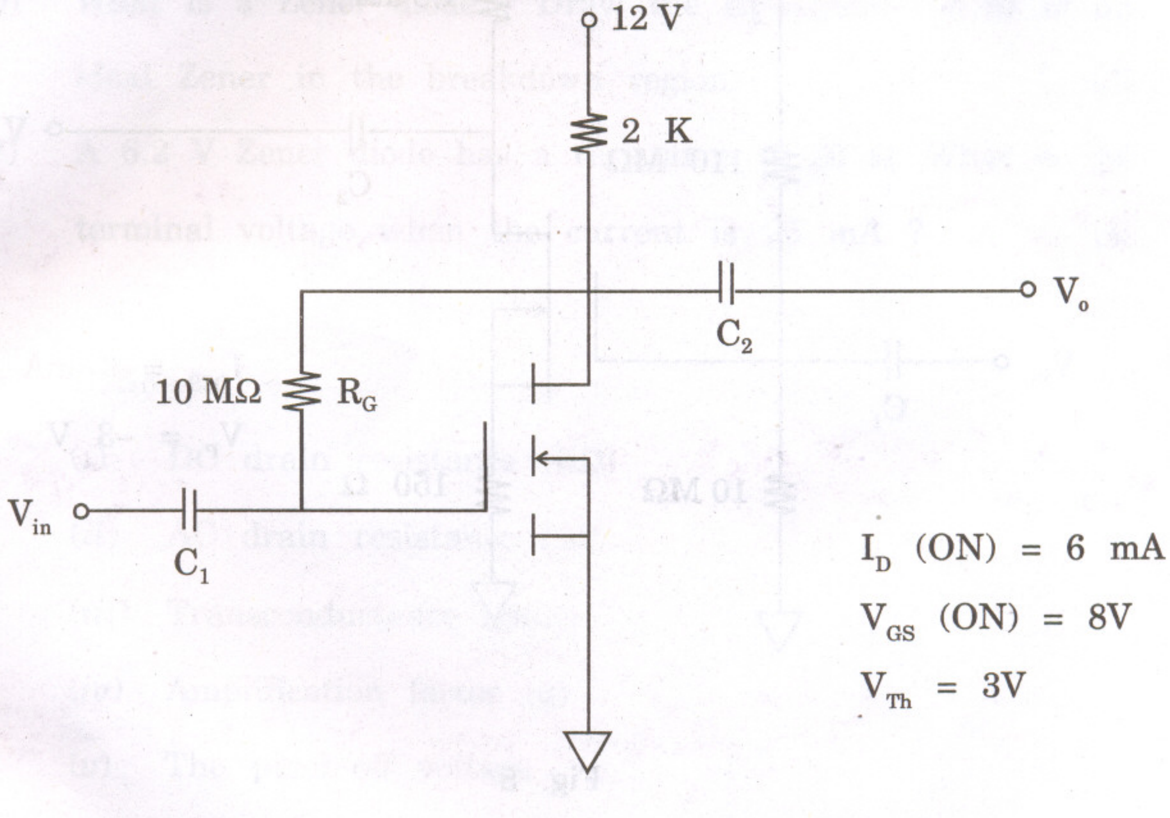

Fig. 4

(c) Bring out a neat comparison between a JFET and a MOSFET. [4]

Or

8. (a) Describe the construction and explain the operation of depletion type MOSFET, also draw the static characteristics. [8]

(*b*) While handling CMOS devices what precautions should be taken ? [4]

(*c*) Find out the values of I_{DQ}, V_{GSQ} and V_{DSQ} for the ckt. shown in Fig. 5. [6]

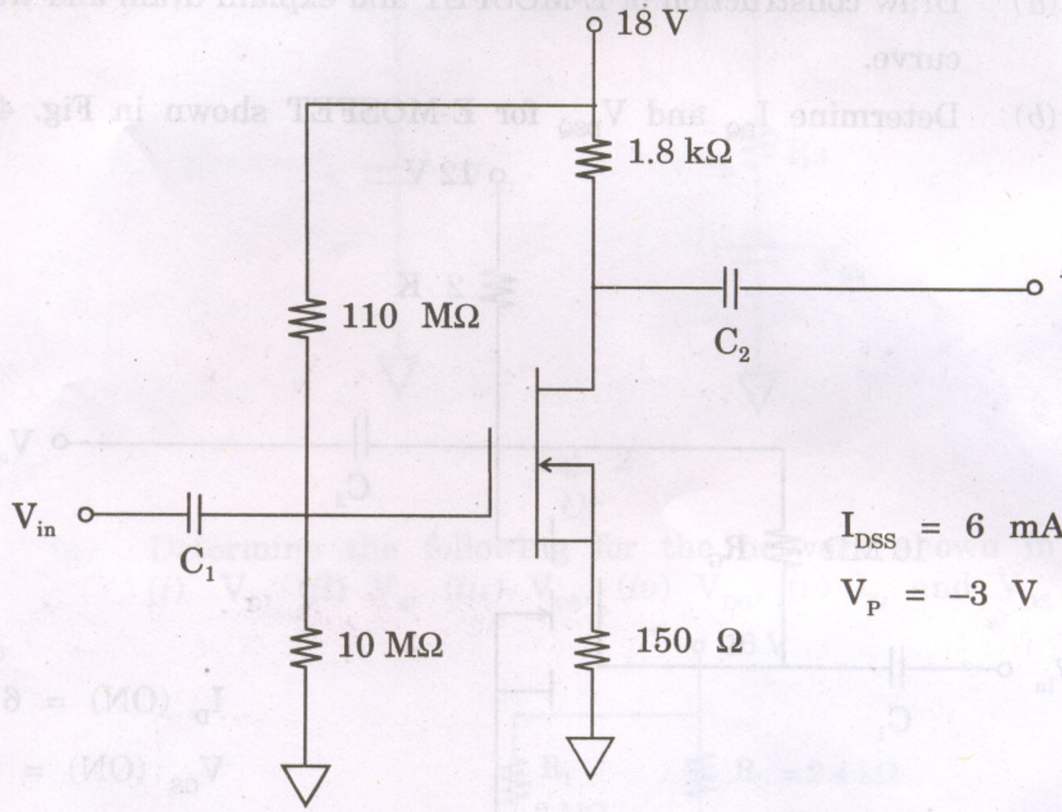

Fig. 5

9. (*a*) What are the different ways of biasing a transistor ? Which method of biasing commonly used for operating transistor as an amplifier and why ? [6]

(*b*) Define α and β and derive the relation between α and β of a transistor. [4]

(*c*) For a single stage CE amplifier shown in Fig. 6 with

$R_S = 1\ k\Omega$, $R_1 = 50\ k\Omega$, $R_2 = 2\ k\Omega$

$R_C = 2k\Omega$ and $R_L = 2k\Omega$

$h_{ie} = 1.1\ K$

$h_{oe} = 25\ \mu A/V$

and $h_{re} = 2.5 \times 10^{-4}$

find out A_{is}, R_i, A_{VS} and R_O

$$A_{is} = \frac{I_L}{I_S}, \quad A_{VS} = \frac{V_o}{V_s}$$ [6]

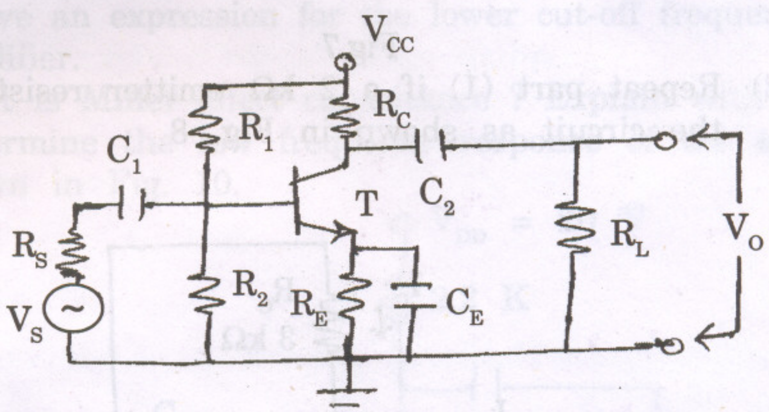

Fig. 6

Or

10. (*a*) Derive an expression for current gain, voltage gain, input impedance and output impedance of CE amplifier for small signal model. [8]

(*b*) (1) Find out transistor current in ckt. shown in Fig. 7, a silicon transistor with $\beta = 100$ and $I_{CO} = 20$ nA is under consideration and specify in which region transistor operates.

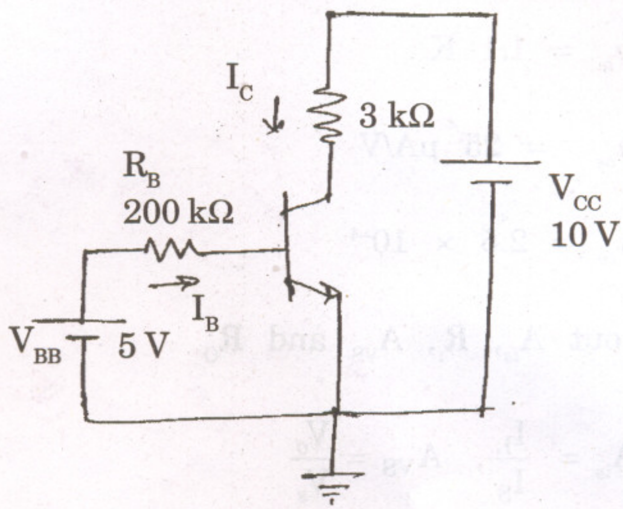

Fig.7

(2) Repeat part (1) if a 2 kΩ emitter resistor is added to the circuit as shown in Fig. 8 [8]

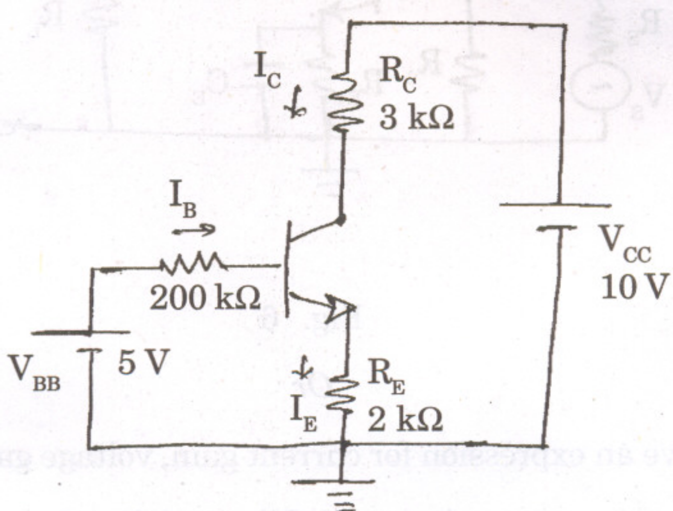

Fig. 8

11. (*a*) What are the factors that affect the low and high frequency response of BJT amplifier and FET amplifiers ? Justify with reasons. [6]

(*b*) Determine the high frequency response of the amplifier ckt. shown in Fig. 9 [8]

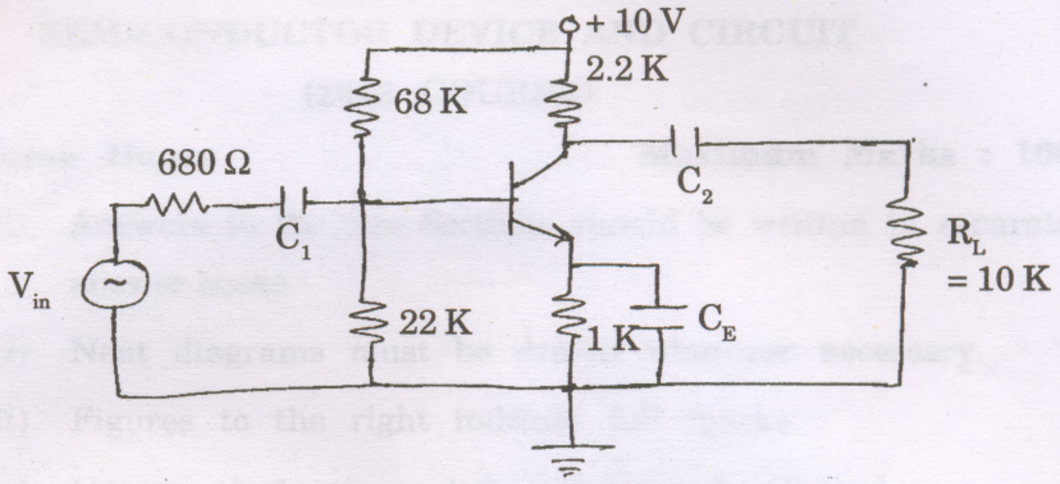

Fig. 9

(*c*) What is decibel unit ? Why is it required ? [2]

Or

12. (*a*) Derive an expression for the lower cut-off frequency of a BJT amplifier. [6]

(*b*) What is Miller effect capacitance ? Explain with example. [4]

(*c*) Determine the low frequency response of the amplifier ckt. shown in Fig. 10. [6]

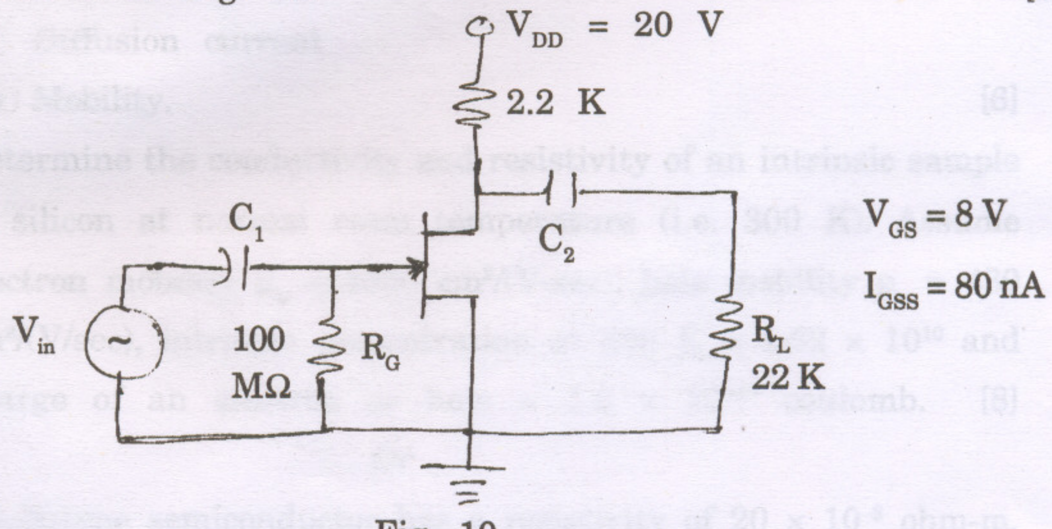

Fig. 10

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S.E. (Elex/ETC) (First Sem.) EXAMINATION, 2008

NETWORK THEORY

(2003 COURSE)

Time : Three Hours **Maximum Marks : 100**

N.B. :— (*i*) Answer any *three* questions from each Section.

(*ii*) Answers to the two Sections should be written in separate answer books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) For the circuit shown in Fig. 1(*a*), find the branch currents I_1, I_2 and I_3 and node voltages V_1 and V_2. [6]

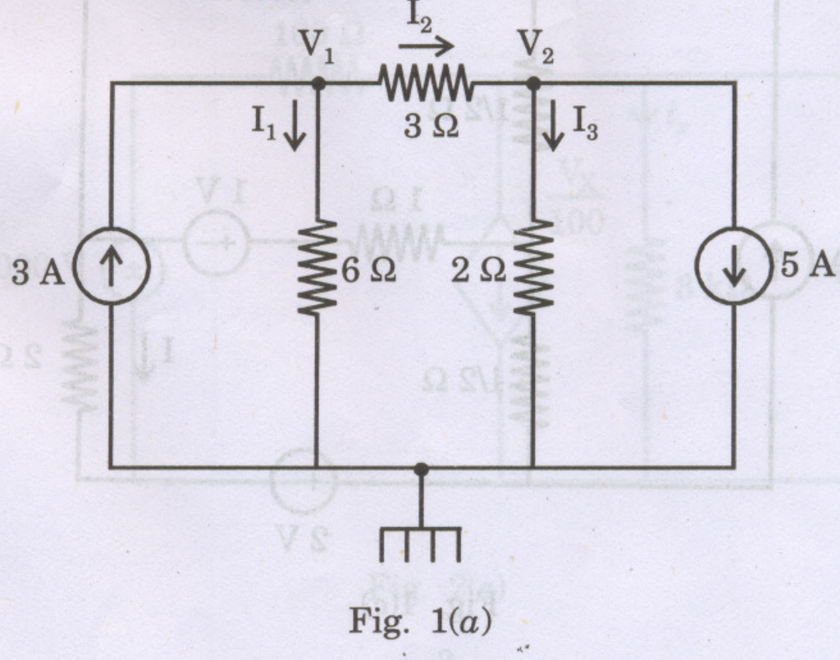

Fig. 1(*a*)

(*b*) For the network shown in Fig. 1(*b*), find $V_a(t)$ in the steady state if $V_1 = 2 \sin 2t$. [6]

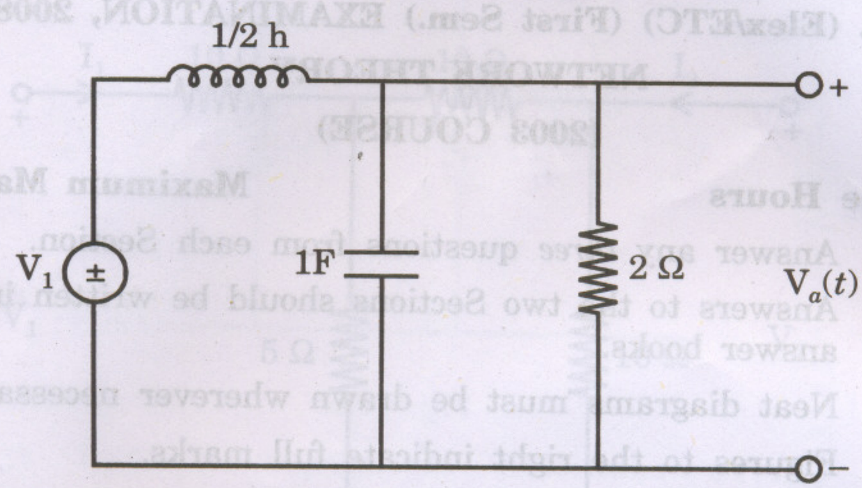

Fig. 1(*b*)

(*c*) Using source shifting and source transformation, find current 'I' in the circuit shown in Fig. 1(*c*). [6]

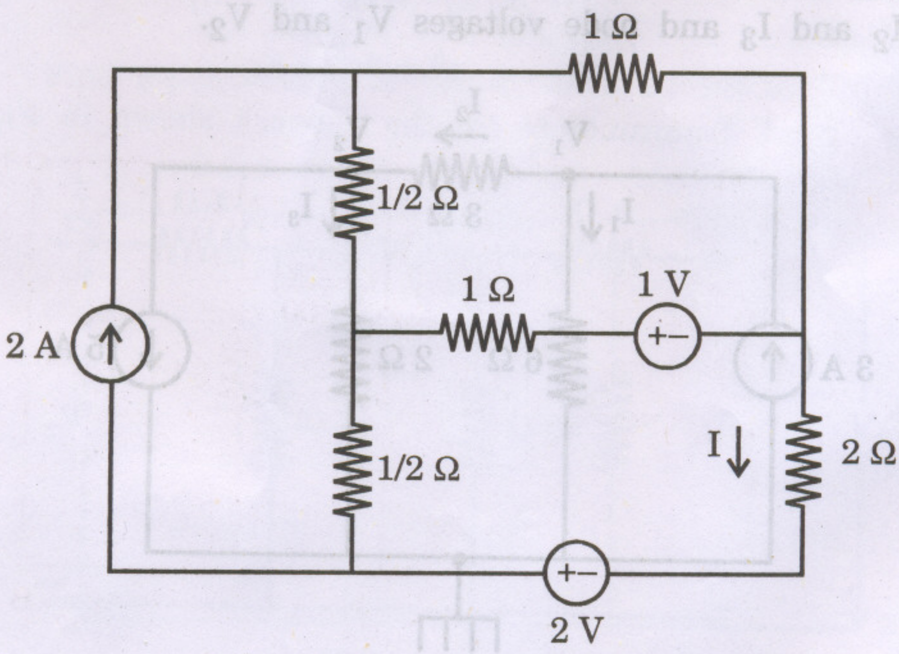

Fig. 1(*c*)

Or

2. (*a*) Determine the voltage V_1 in the circuit by using the superposition theorem. Refer Fig. 2(*a*). [6]

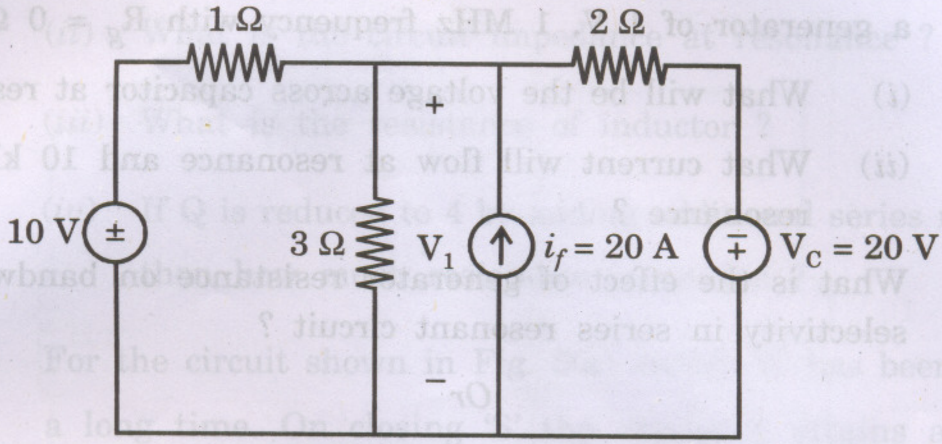

Fig. 2(*a*)

(*b*) State and prove maximum power transfer theorem. [6]

(*c*) Find Thevenin and Norton equivalent circuit across A-B in the circuit shown in Fig. 2(*c*). [6]

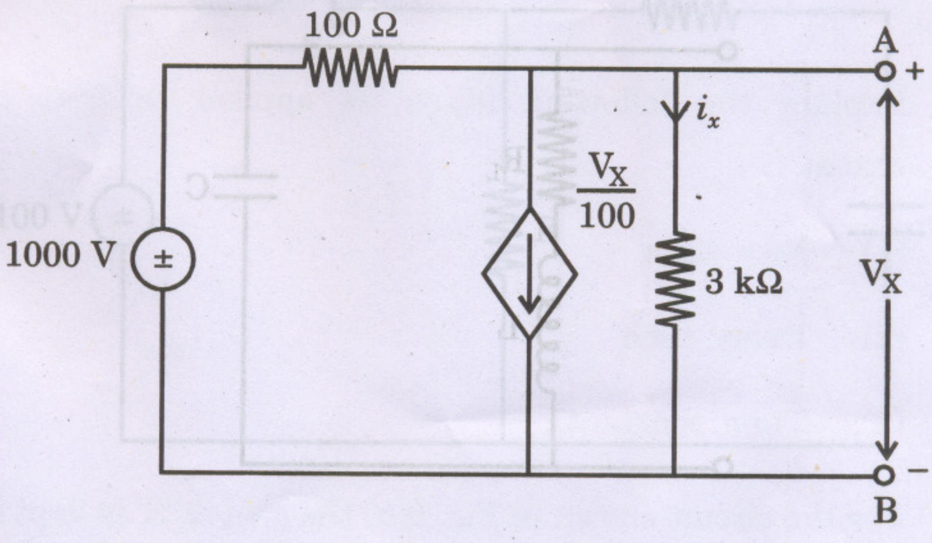

Fig. 2(*c*)

3. (*a*) Derive the expression for the impedance of a series resonating circuit in terms of Q_0 and δ. [6]

(*b*) A series circuit of negligible resistance and coil of 120 μH with 18 Ω resistance is resonated at 1 MHz. The circuit is driven by a generator of 1 V, 1 MHz frequency with $R_g = 0\ \Omega$.

(*i*) What will be the voltage across capacitor at resonance ?

(*ii*) What current will flow at resonance and 10 kHz above resonance ? [4]

(*c*) What is the effect of generator resistance on bandwidth and selectivity in series resonant circuit ? [6]

Or

4. (*a*) Give important property of series resonant circuit. Also give application of this circuit. [4]

(*b*) In the circuit shown in Fig. 4(*b*) the inductance of 0.1 H having Q factor of 5 is in parallel with capacitor. Determine the value of capacitance and coil resistance at resonant frequency of 500 rad/sec. [6]

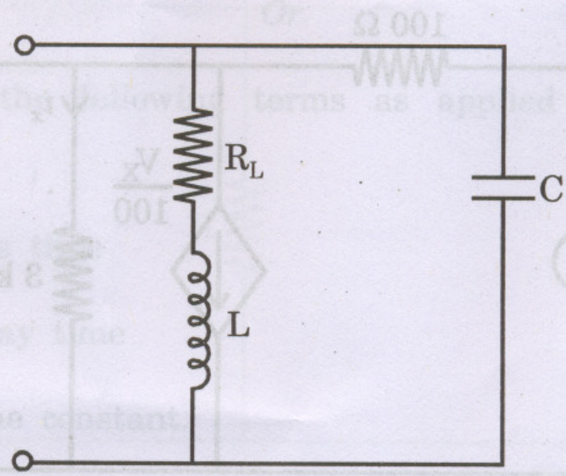

Fig. 4(*b*)

(*c*) A parallel resonant circuit has a coil of 150 μH with Q of 60 and resonated at 1 MHz.

(*i*) Specify the value of required capacitor.

(*ii*) What is the circuit impedance at resonance ?

(*iii*) What is the resistance of inductor ?

(*iv*) If Q is reduced to 4 by adding additional series resistance, then how much resistance is needed ? [6]

5. (*a*) For the circuit shown in Fig. 5(*a*) switch 'S' has been open for a long time. On closing 'S' the capacitor attains a value of 80 V after 10 ms. The S/W has been closed for long time. When 'S' is opened V_C = 90 V after half a second. Calculate R and C values. [6]

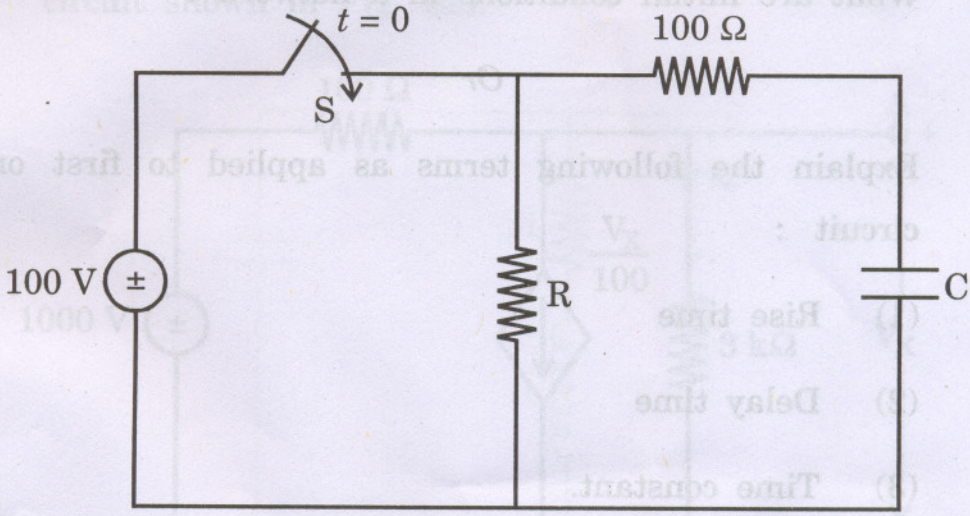

Fig. 5(*a*)

(*b*) The circuit shown in Fig. 5(*b*) was in steady state with switch on position 1. At $t = 0$ it is moved to position 2. Find $i(t)$ using Laplace transform. [6]

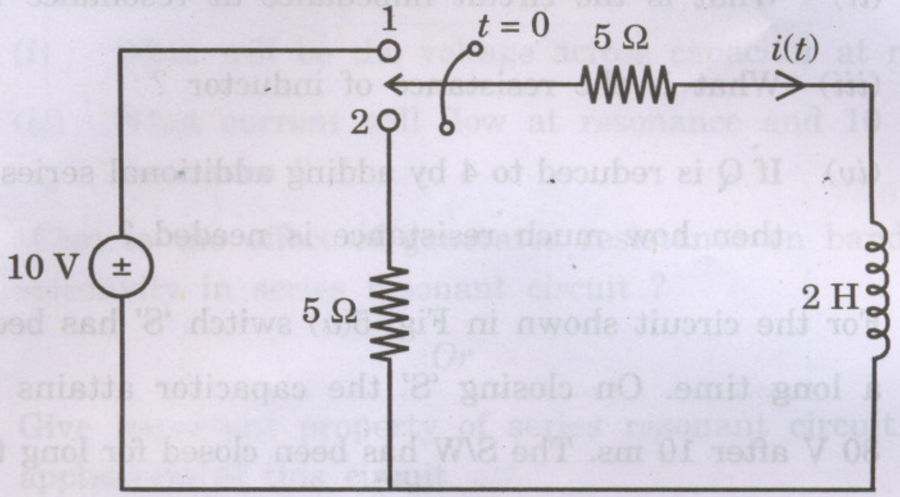

Fig. 5(*b*)

(*c*) What are initial conditions in a network ? [4]

Or

6\. (*a*) Explain the following terms as applied to first order R-C circuit :

(1) Rise time

(2) Delay time

(3) Time constant. [4]

(*b*) For the circuit shown in Fig. 6(*b*) the switch 'S' is kept in position 1 for long period to establish steady state conditions. The switch is then shifted to position 2 at $t = 0$. Find out the expression for current after switching the switch to position 2. [6]

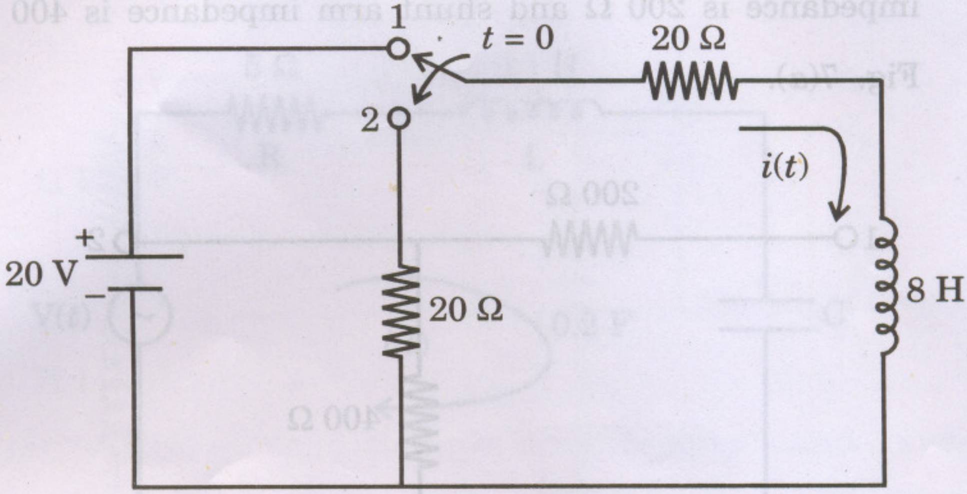

Fig. 6(*b*)

(*c*) In the network shown in Fig. 6(*c*) the switch K is moved from position '*a*' to '*b*' at $t = 0$ (a steady state existing in position '*a*' before $t = 0$). Solve for the current $i(t)$, using Laplace transform. [6]

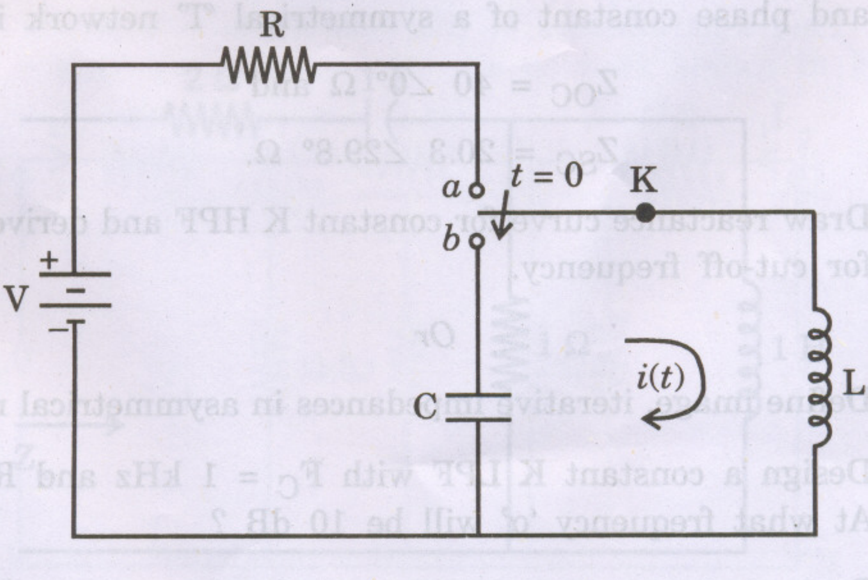

Fig. 6(*c*)

SECTION II

7. (*a*) Find an iterative impedance for L section whose series arm impedance is 200 Ω and shunt arm impedance is 400 Ω. Refer Fig. 7(*a*). [6]

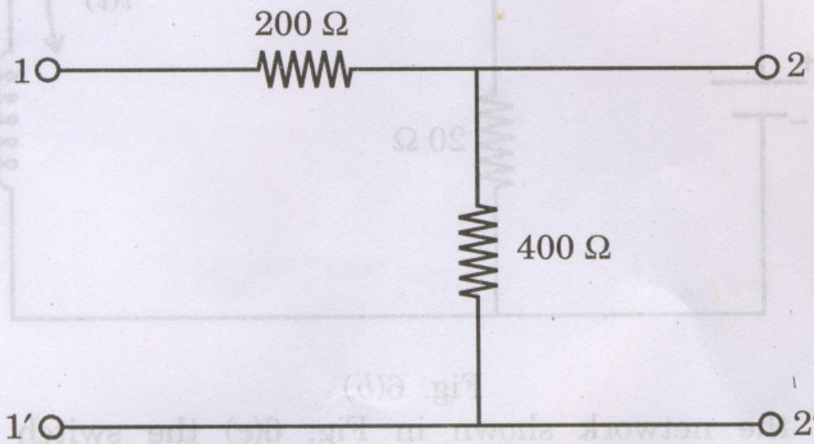

Fig. 7(*a*)

(*b*) Calculate the characteristic impedance, an attenuation constant and phase constant of a symmetrical 'T' network if,

$$Z_{OC} = 40 \angle 0° \ \Omega \text{ and}$$

$$Z_{SC} = 20.3 \angle 29.8° \ \Omega.$$ [6]

(*c*) Draw reactance curve for constant K HPF and derive expression for cut-off frequency. [4]

Or

8. (*a*) Define image, iterative impedances in asymmetrical network. [4]

(*b*) Design a constant K LPF with F_C = 1 kHz and R_0 = 600 Ω. At what frequency 'α' will be 10 dB ? [6]

(*c*) Design π type attenuater to provide attenuation of 10 dB and working into characteristic impedance of 600 Ω. [6]

9. (a) State the necessary condition for driving point functions. [4]

(b) For the circuit shown in Fig. 9(b), find the driving point impedance and driving point admittance. [6]

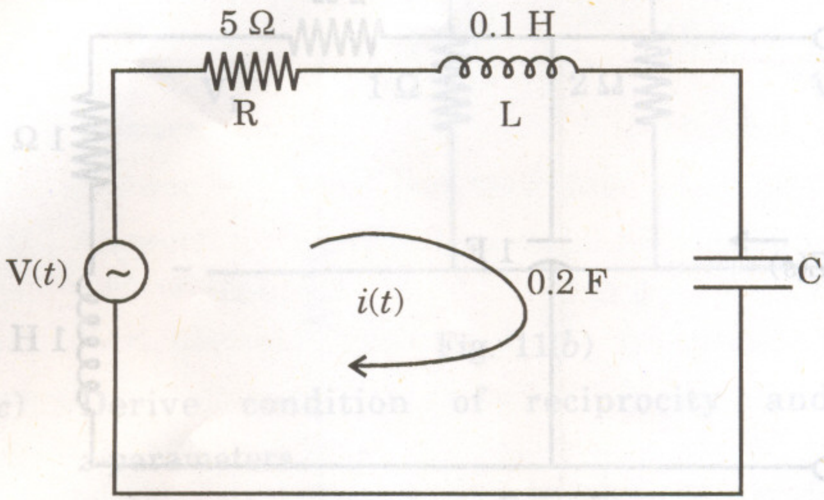

Fig. 9(b)

(c) Find input impedance $Z_{in}(S)$ and plot its poles and zeros for the circuit shown in Fig. 9(c). [6]

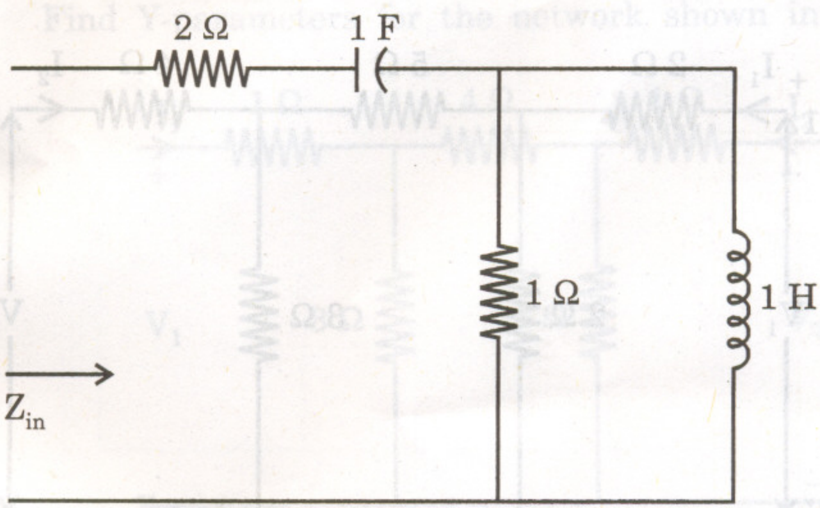

Fig. 9(c)

Or

10. (*a*) Explain significance of poles and zeros. [4]

(*b*) Find driving point impedance and driving point admittance for the circuit shown in Fig. 10(*b*). [6]

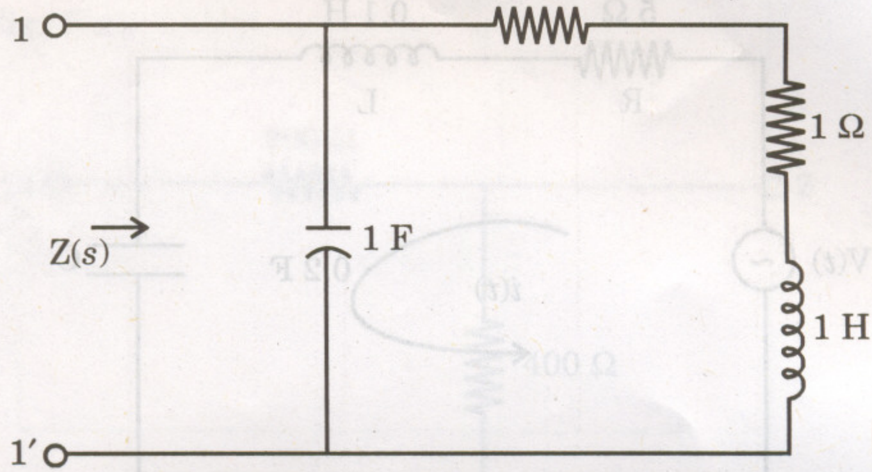

Fig. 10(*b*)

(*c*) Draw pole zero plot for following function :

$$H(s) = \frac{s^2 + 4}{s^2 + 6s + 4}.$$ [6]

11. (*a*) Find *z*-parameters of the network shown in Fig. 11(*a*). [6]

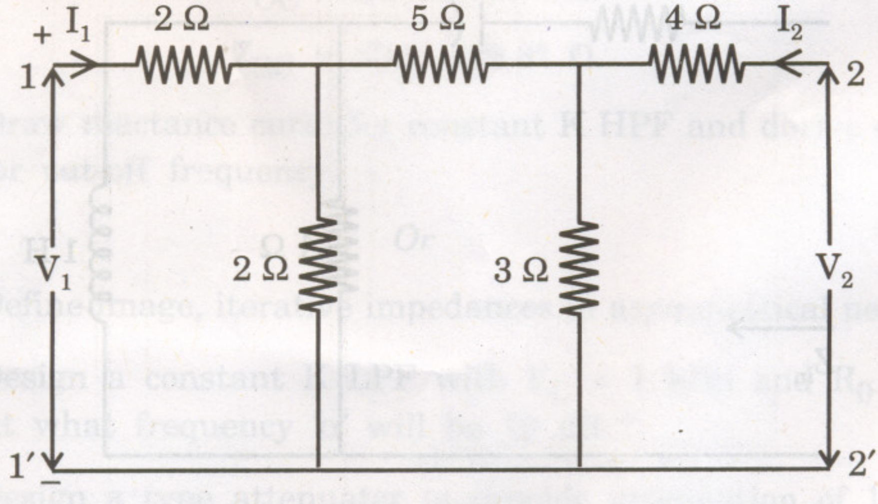

Fig. 11(*a*)

(*b*) Find *h*-parameters for the network shown in Fig. 11(*b*). [6]

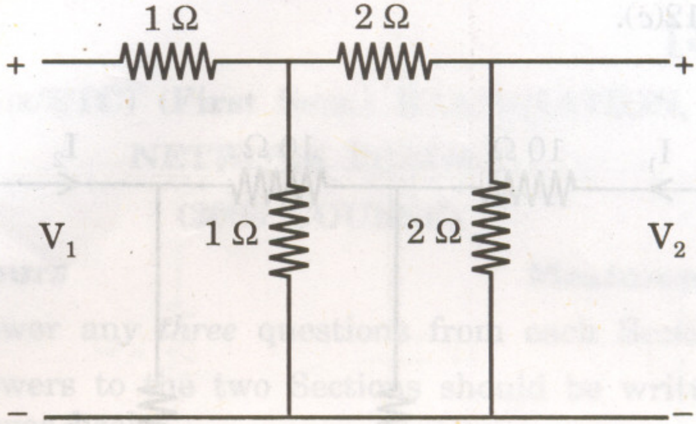

Fig. 11(*b*)

(*c*) Derive condition of reciprocity and symmetry for *z*-parameters. [6]

Or

12. (*a*) State wheather the following function is suitable for driving point function analysis :

$$Z(s) = \frac{5\left(4s^3 + 2s^2 + s + 2\right)}{s^4 + 3s^3 + 4s}.$$ [4]

(*b*) Find Y-parameters for the network shown in Fig. 12(*b*). [8]

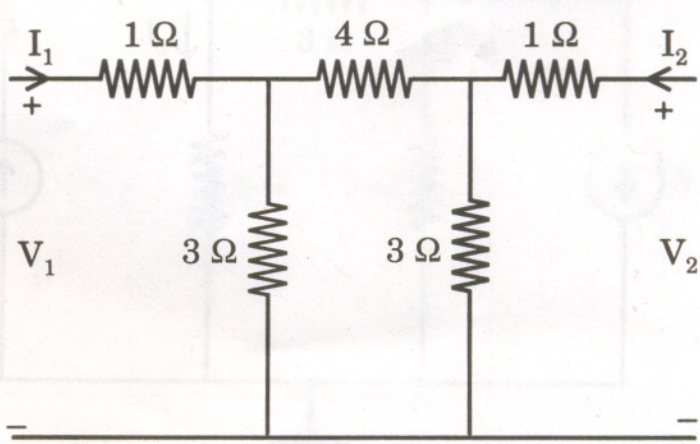

Fig. 12(*b*)

(c) Determine transmission parameter of the network shown in Fig. 12(c). [6]

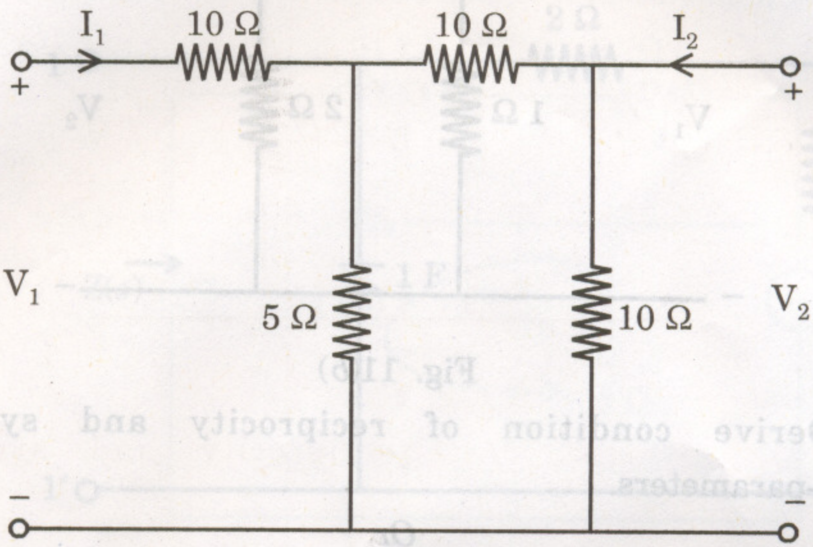

Fig. 12(c)

Total No. of Questions—12] [Total No. of Printed Pages—4+2

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S.E. (E&TC) (First Semester) EXAMINATION, 2008

CONTROL SYSTEMS

(2003 COURSE)

Time : Three Hours **Maximum Marks : 100**

N.B. **:—** (*i*) Answers to the two Sections should be written in separate answer-books.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Define the following with an example for each :

(1) Closed loop system;

(2) Non-linear system;

(3) Feed forward system;

(4) Linear system. [8]

(*b*) Reduce the following block diagram and obtain the Transfer function $\frac{C(s)}{R(s)}$ Fig. 1. [8]

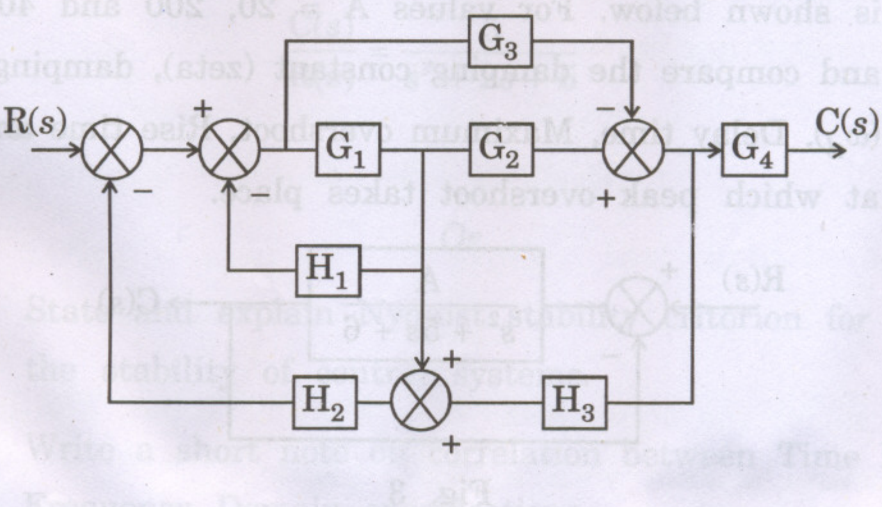

Fig. 1

P.T.O.

Or

2. (*a*) Compare and contrast with suitable example :

(1) Open loop system and closed loop system;

(2) Feedback control system and Feed forward control system. [8]

(*b*) Obtain the transfer function for the following SFG using Mason's gain formula Fig. 2. [8]

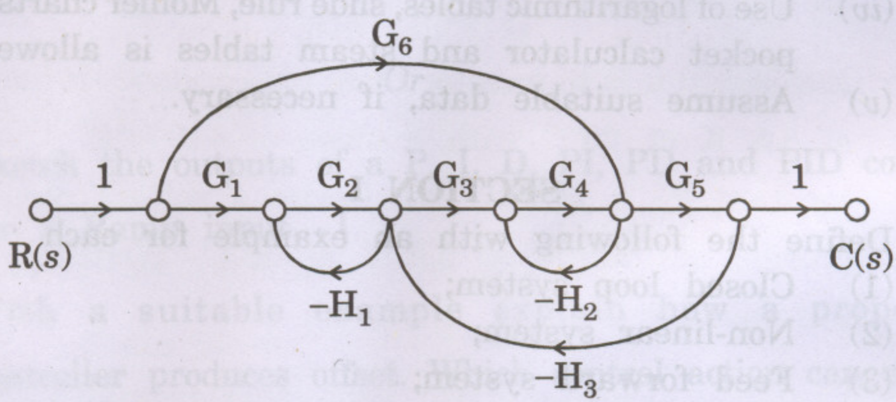

Fig. 2

3. (*a*) The block diagram (Fig. 3) of a unity feedback control system is shown below. For values A = 20, 200 and 400 find out and compare the damping constant (zeta), damping frequency (ω_d). Delay time, Maximum overshoot, Rise time and the time at which peak overshoot takes place. [12]

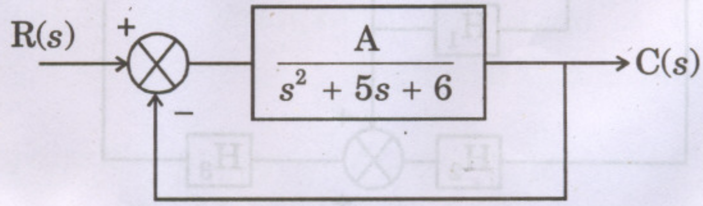

Fig. 3

(*b*) Explain Routh-Hurwitz criterion for stability. [4]

Or

4. (*a*) Determine the range of K so that the system with the following characteristic equation will be stable :

$$s(s^2 + 2s + 3)(s + 2) + K = 0.$$ [4]

(*b*) Sketch the root locus for the system having :

$$G(s)\,H(s) = \frac{K}{s(s+3)(s+5)}\; K > 0.$$

Comment on the stability. [12]

5. (*a*) A feedback control system has :

$$G(s)\,H(s) = \frac{100(s+3)}{s(s+1)(s+5)}.$$

Draw the Bode plot and comment on stability. [12]

(*b*) Determine the Resonant peak (M_r) and Resonant frequency (ω_r) for the system whose transfer function is :

$$\frac{C(s)}{R(s)} = \frac{5}{s^2 + 2s + 5}.$$ [6]

Or

6. (*a*) State and explain Nyquist stability criterion for determining the stability of control systems. [6]

(*b*) Write a short note on correlation between Time Domain and Frequency Domain specifications. [4]

(*c*) A feedback control system has the open loop transfer function :

$$G(s)\,H(s) = \frac{100}{s(s+5)}.$$

Draw the Nyquist plot and determine the closed loop stability. [8]

SECTION II

7. (*a*) Define the following :

(1) State

(2) State variables

(3) State vector

(4) State space. [4]

(*b*) What are the advantages of state space techniques over transfer function approach ? [4]

(*c*) Obtain the State Space Model for the system given below having overall transfer function :

$$\frac{Y(s)}{U(s)} = \frac{3s+4}{s^2+5s+6}.$$ [8]

Or

8. (*a*) Explain the state model of a Multiple Input, Multiple output control system with a block diagram. [4]

(b) State the properties of State Transition Matrix. [4]

(c) Obtain the State Transition Matrix for the system :

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -2 & 3 \\ 0 & -3 \end{bmatrix} x(t).$$ [8]

9. (a) What is meant by the Gauge Factor of a strain gauge ? Derive an expression for the same. [8]

(b) A thermistor is to monitor room temperature. It has a resistance of 3.5 K at 20°C with a slope of –10%/°C. The dessipation constant P_D = 30 mW|°C. Devise a voltage divider circuit to provide an output of 5.0 V at 20°C. What is the effect of self heating ? [4]

(c) Sketch a Piezo-electric type accelerometer. Where is it used ? [4]

Or

10. (a) Sensor resistance changes linearly from 100 Ω to 180 Ω as temperature changes from 20°C to 120°C. Find the equation relating resistance and temperature. [4]

(b) With a neat sketch explain the capacitance type level measurement technique. [8]

(c) State the advantages of semiconductor strain gauges over metallic strain gauges. [4]

11. (*a*) A PI controller has $K_P = 4.5$ and $K_I = 7\ sec^{-1}$. Find the controller output for an error $E_P = 3 \sin(\pi t)$. [4]

(*b*) How do you interpret the NO and NC symbols in Relay ladder logic and PLC ladder logic ? [4]

(*c*) Draw the PLC ladder diagram for a Bottle Filling System. Consider all sensors as direct inputs to the PLC. [10]

Or

12. (*a*) Sketch the outputs of a P, I, D, PI, PD and PID controllers for a Ramp input. [6]

(*b*) With a suitable example explain how a proportional controller produces offset. Which control action can eliminate this ? [4]

(*c*) With a block diagram explain the working of a PLC. What are its advantages over control relays ? [8]

Total No. of Questions—12] [Total No. of Printed Pages—4+1

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S.E. (E & TC) (First Sem.) EXAMINATION, 2008

DIGITAL SYSTEMS

(2003 COURSE)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer any *three* questions from each Section.

(*ii*) Answers to the two Sections should be written in separate Answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Assume suitable data, if necessary.

(*vi*) Solve question Q. **1** *or* Q. **2**, Q. **3** *or* Q. **4**, Q. **5** *or*. Q. **6** from Section I and Q. **7** or Q. **8**, Q. **9** *or* Q. **10**, Q. **11** *or* Q. **12** from Section II.

SECTION I

1. (*a*) With neat circuit diagram explain the working of 2 i/p NAND gate (TTL). [6]

(*b*) Describe the characteristics of CMOS family and explain the operation of CMOS inverter. [6]

(*c*) Explain with a neat circuit diagram interfacing of TTL and CMOS gates. [6]

Or

2. (*a*) Define and explain :

(1) Fan out

(2) Wired ANDing

(3) Figure of merit

(4) Power dissipation

(5) Propagation delay. [10]

(*b*) Draw and explain the working of 2 i/p CMOS NOR gate. What do you mean by current sinking and current sourcing in TTL gates ? [8]

3. (*a*) Minimize the function using K map and implement using NOR gates only : [8]

$$f(A, B, C, D) = \Pi M(0, 1, 3, 4, 5, 7, 9)$$

(*b*) Implement EX-OR gate using NOR gates. [4]

(*c*) Represent (–15) using :

(1) Sign magnitude form

(2) 1's complement form

(3) 2's complement form. [4]

Or

4. (*a*) Design and implement a 4-bit binary to gray code converter using discrete gates. [8]

(*b*) Convert :

(1) $(95)_{10} = (\quad)_8 = (\quad)_{16}$

(2) $(1100)_2 = (\quad)_{gray}$

(3) $(5)_{10} = (\quad)_7$ segment code (common anode) [4]

(*c*) Draw the circuit diagram and explain the working for a multiplexed common cathode display using IC 7447. [4]

5. (*a*) Implement the following function using 4 : 1 multiplexers :

$$f(A, B, C, D) = \sum m(1, 3, 6, 8, 10, 11, 15)$$ [8]

(*b*) A combinational circuit is defined by the function : [8]

$$F_1(A, B, C) = \sum m(1, 3, 5)$$

$$F_2(A, B, C) = \sum m(2, 4, 5)$$

Implement a circuit with PLA.

Or

6. (*a*) Design and implement a full adder circuit using a 3 : 8 decoder. [8]

(*b*) Compare PLA and PAL. [4]

(*c*) Design 9's complement or circuit using 4-bit adder 7483. [4]

SECTION II

7. (*a*) Design and implement a 3-bit up/down asynchronous counter. [6]

(*b*) Convert a J-K f/f into D f/f and T f/f. [8]

(*c*) Design Johnson's counter using 2-bit shift register. Draw the waveforms. [4]

Or

8. (*a*) Design a mod 25 counter using IC 7490. [6]

(*b*) Draw the logical diagram of 4-bit bidirectional shift register. Explain shift left and shift right operation. [8]

(*c*) Explain race around condition. How can this condition be eliminated ? [4]

9. (*a*) Design a sequence detector for the following sequence : [8]

— — 110 — —

(*b*) Design mod 9 counter using IC 74191. [4]

(*c*) Distinguish between Mealy and Moore machines. [4]

Or

10. (*a*) Design a sequence generator using shift register to generate the following sequence : [8]

— — 1101011 — —

(*b*) Explain :

(1) State table

(2) State diagram

(3) Rules for state reduction. [6]

(*c*) Give the advantages and disadvantages of synchronous counters over asynchronous counters. [2]

11. (*a*) Explain with block diagram successive approximation A/D converter. [8]

(*b*) Explain various types of ROMs and their applications. [8]

Or

12. (*a*) Explain the following terms w.r.t. DAC :

(1) Resolution

(2) Linearity

(3) Accuracy

(4) Setting time. [8]

(*b*) Explain the characteristics of the following memories :

(1) NURAM

(2) SDRAM

(3) DRAM

(4) RAM. [8]