Electronics & Telecommunication Engineering

1. **(a)** For a fullwave rectifier with a capacitor filter, show that the ripple voltage-V_r is inversely proportional to the capacitor C and is proportional to the load current I_{dc}. Calculate the value of 'V_r' when C = 100 μF and I_{dc} = 10 mA. The a.c. input voltage to the rectifier is given by $v = V_m \sin 314t$.

(b) Obtain the minimal SOP expression for Y(A, B, C, D) = Σm (2, 3, 5, 7, 8, 9, 11, 12, 13, 14, 15) + d(2, 4) using K-map. Realize the expression using 2 input NAND gates only.

(c) Design a mod-7 asynchronous up counter using JK flip-flops. Write the state diagram and the timing diagram for the same. The counter counts during positive edges of the clock.

(d) State and explain minimum phase and non-minimum phase transfer functions with examples.

(e) Obtain the overall transfer function of an armature controlled d.c. shunt motor. Explain the difference between armature controlled and field controlled d.c. motor.

(f) An optical fibre has a core refractive index of 1.45 and a cladding refractive index of 1.4. Assuming ray theory of analysis, determine the following:

(i) Numerical aperture of the fibre.
(ii) Acceptance angle in air for fibre.
(iii) Critical angle at core-cladding interface.

(g) (i) Assuming a geosynchronous satellite global beam covering all visible earth surface with 100% efficiency, calculate its G/T ratio, if earth radius is 6400 km and altitude of satellite is 6000 km (Noise temperature of satellite antenna is 290^{O} K).

(ii) What are the classification of satellites in terms of distance from earth and position from earth?

(h) Microwave signal of 9.2 GHz is propagating in dominant mode through a rectangular waveguide filled with air. If inside dimensions of the waveguide are 2 cm x 1 cm, calculate the following:

(i) Cut of frequency
(ii) Guide wavelength
(iii) Phase velocity
(iv) Characteristic impedance.

Sketch also the method of excitation of TE_{10} mode and TE_{20} mode in a rectangular waveguide.

(i) Convert the following:

(i) Decimal number into octal

$(5621.125)_{10}$

(ii) Hexadecimal number into octal and into binary

$(5621)_{16}$.

(j) Write a 'C' program to print first twenty Fibonacci number (Fib (i)) using the formula:

$$\text{Fib}\ (i) = \text{Fib}\ (i-1) + \text{Fib}(i-2)$$

Where i is an integer $\geq$ 0.

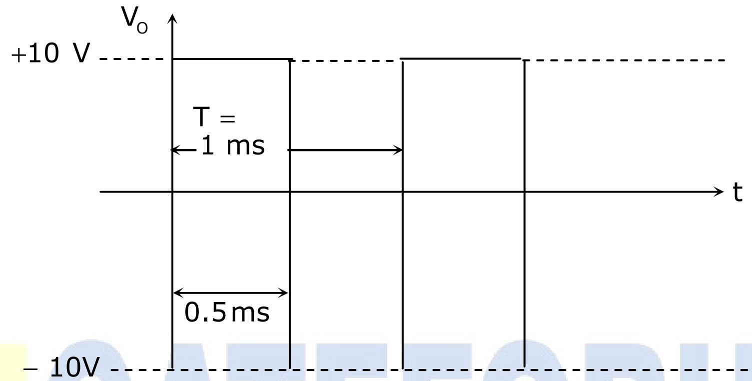
It is given that

$$\text{Fib}\ (0) = \text{Fib}(1) = 1$$

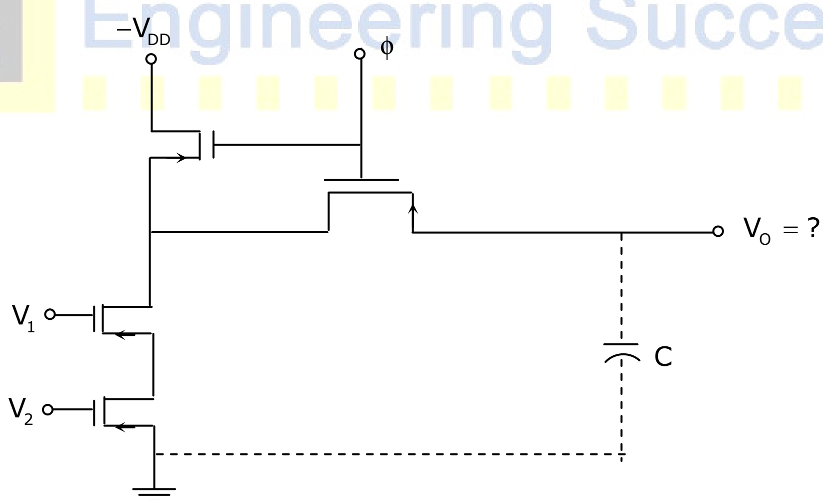
Section – A

2. **(a)** Design a self bias circuit for a CE amplifier using an npn transistor with $\beta = 100$. The other details are : $V_{CC} = 12\,V$, $V_{CEQ} = 6V$, $I_{CQ} = 4\,mA$.

(b) Design an op-amp waveform generating circuit to produce the waveform given in figure below. Explain the circuit operation with other relevant waveform.



(c) Identify the logic gate shown below. Explain the operation of the same with the help of truth table.



3. **(a)** Write the counting sequence of a 4 bit down synchronous counter. Design the same using negative edge triggered J–K Flip-Flops.

(b) Design a Schmitt trigger circuit using an op-amp which has a maximum output voltage of $\pm 10\,V$. The 'hysteresis' – V_H should be = 0.4V. Explain the working of the circuit with the transfer characteristics. Use of reference voltage V_R = 2V.

(c) Implement the following expressions using CMOS-AOI logic circuits. Verify the circuit operation with the help of truth table:

(i) $Y = A + BC$

(ii) $Y = \overline{AB + CD}$

4. **(a)** Explain the difficulties involved in the application of Routh-Hurwitz criterion and also bring out limitations. Find the stability of the control system whose characteristic equation is given by

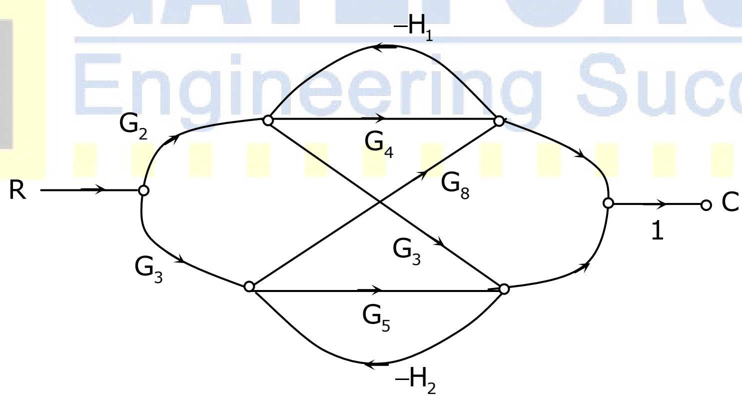
$$(s-1)^2 (s+2)\ (s+1) = 0$$

(b) Explain the effect of additional poles and zeros of G(s) H(s) on the shape of the Nyquist plot. Sketch the Nyquist diagram and determine stability of the transfer function:

(i) $G(s)H(s) = \dfrac{s}{1-0.2s}$

(ii) $G(s)H(s) = \dfrac{s+2}{(s+1)\ (s-1)}$

(c) Obtain the overall transfer function C/R from the signal flow graph given below



SECTION-B

5. **(a)** A voice grade telephone circuit has to transmit audio signal in digital signal form. Suggest and explain the scheme for the same with suitable block diagram. Calculate the data rate if an ADC of 12 bits is used in your scheme.

(b) An optical fiber link has the following details:

Laser diode output = 3 dBm

In GaAS APD sensitivity = -32 dBm

Optical fiber attenuation = 0.25 dB/km

Connector loss at each end = 1dB

Power margin = 6 dB.

Calculate the link distance. Represent this link loss budget graphically.

(c) With the help of a block diagram explain the working of a Super heterodyne AM receiver.

6. **(a)** Sketch the structure, field distribution and doping profile of an IMPATT diode. With the help of appropriate voltage and current plots in IMPATT diode, show how negative resistance is obtained in it.

(b) In the case of an IMPATT having carrier

drift velocity $v_d = 4 \times 10^5 m/sec$

Drift region length L= 12μm

Breakdown voltage V_{bd} = 90 V

Maximum operating voltage V_{max} = 100V

Maximum operating current I_{max} = 100mA

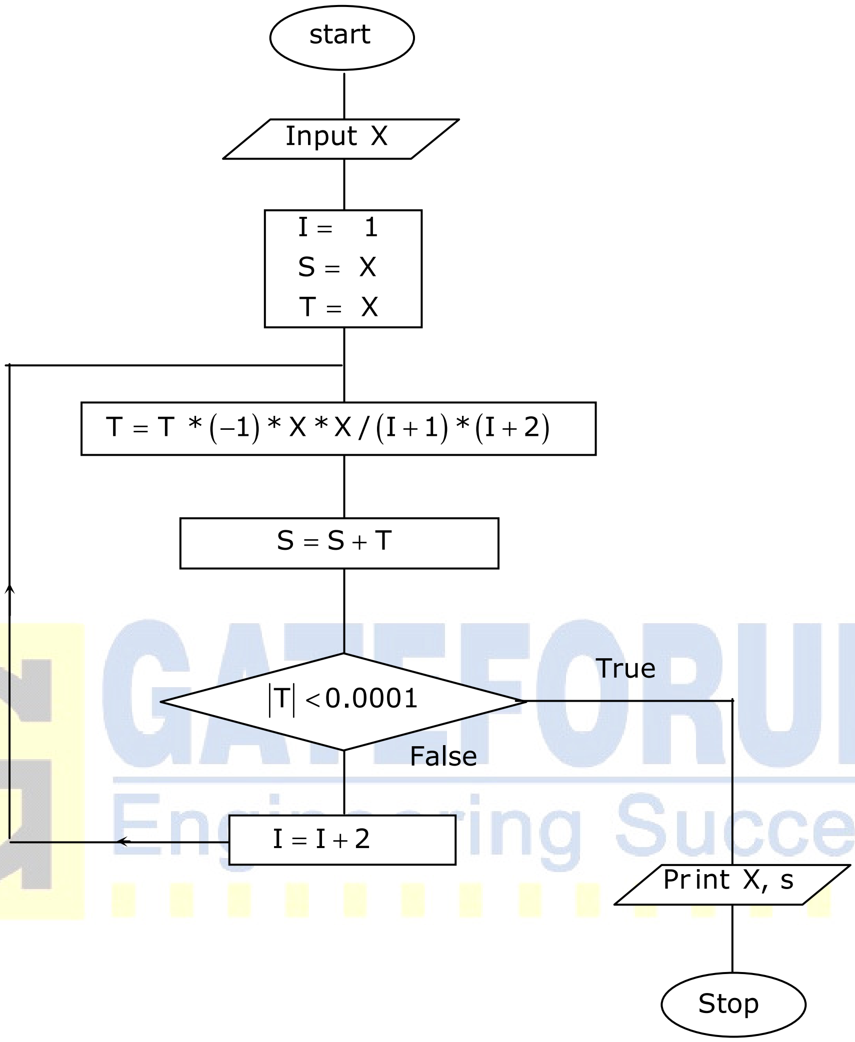
Efficiency $\eta = 10\%$

Determine the resonant frequency and maximum CW output power.

(c) Sketch an antenna radiation pattern in polar co-ordinates. With reference to the antenna radiation pattern, show side lobe level, half power beam width and null width. Define gain of an antenna. How is it related to effective aperture area? What is difference between isotropic antenna and omnidirectional antenna?

(d) A parabolic antenna is operating at S-band mid frequency. If the frequency is now shifted to X-band mid frequency, determine the approximate increase in gain in dB.

7. **(a)** What is done by the following program flow chart? Give a trace (print out) of all the variables till I = 5 for X = 0.5.



(b) What is done by the following assembly language program? Explain.

	LXI	H, TABLTOP
	MOV	C, M
LP2	INX	H
	MOV	E, M
	INX	H
	MOV	D,M
	INX	H
	MOV	B, M
	INX	H
	MVI	M, OO

LP1	MOV	A, E
	SUB	B
	MOV	E,A
	MOV	A,D
	SBI	OO
	JM	LBL1
	INR	M
	MOV	D,A
	JMP	LP1
LBL1	MOV	A, E
	ADD	B
	INX	H
	MOV	M, A
	DCR	C
	JNZ	LP2
	RET	

Programme variable:

TABLTOP EQU 19ϕϕH.

(c) How many interrupt lines are there in Intel 8085?

Name them in order of priority. Give their restart location also.