VINAYAKA MISSION'S UNIVERSITY

V.M.K.V ENGINEERING COLLEGE, SALEM

DEPARTMENT OF ELECTRONICS & COMMUNICATION

ELECTRONICS CIRCUITS II
(COMMON TO ECE & ETCE)

V SEMESTER

QUESTION BANK

UNIT I
PART A

1. Define Negative and Positive Feedback.
2. Define Feedback factor.
3. Explain Desensitivity
4. Explain Sampling Network
5. What are the advantages of Negative Feedback over Positive Feedback?
6. Draw the frequency response of amplifier with feedback and without feedback.
7. What are the effects of negative feedback on distortion and gain?
8. Explain the term Sensitivity.
9. Distinguish between Voltage and Current feedback.
10. Distinguish between shunt and series feedback.
11. List the four types of negative feedback?
12. Draw the equivalent circuit of a Transconductance amplifier?
13. Draw the equivalent circuit of a voltage amplifier?
14. Find closed loop gain of a negative feedback amplifier with open loop gain 600, β=0.01?
15. What are the effects of negative feedback on input and output impedance of amplifier?
16. Explain the effect of noise and distortion in feedback amplifier?
17. Write the formula for closed loop gain?
18. What type of feedback connection?
19. What is the basic difference between feedback in biasing circuits and amplifier circuits?
20. What is open loop gain?
21. Why negative feedback is employed in high gain amplifiers?
22. Define (i) Gain Margin and (ii) Phase Margin.
23. Distinguish positive and negative feedback amplifier.
24. What type of feedback has been used in an emitter follower circuit?
25. An amplifier with stage gain 200 is provided with negative feedback of feedback ratio 0.05.

Find the new gain.

Part – B

1. Explain with relevant information how the negative feedback amplifier improves stability, reduces noise and increases input impedance.

2. a). Draw the block diagram of amplifier with negative feedback and explain.
   b). Explain the consequences of introducing negative feedback in small signal amplifiers .

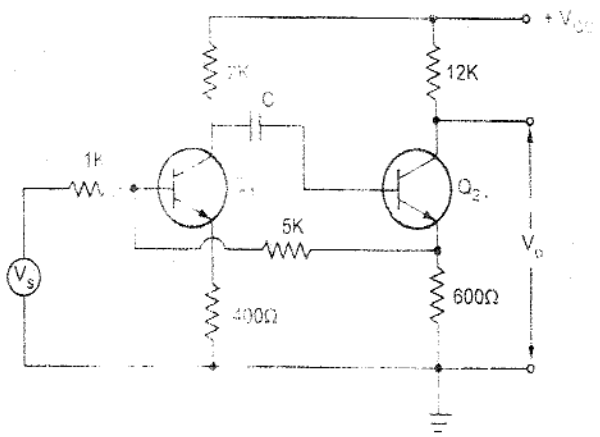
3. What type of feedback is employed in emitter follower amplifier derive an expression for A_{if}, A_{vf}, R_{if}, R_{of}

4. What is the effect of negative feedback on input and output resistance of current shunt feedback amplifier.

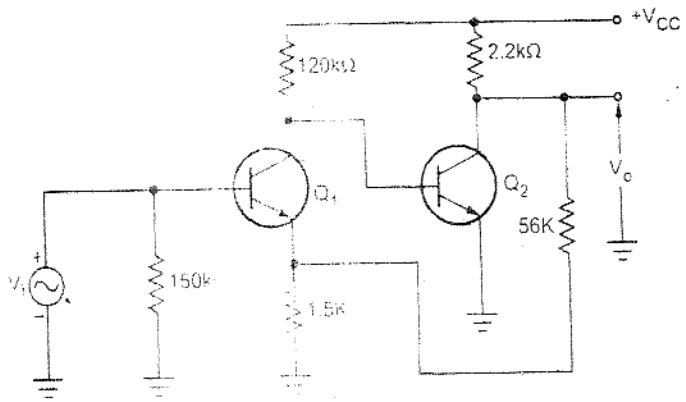
5. What type of feedback is employed in a common emitter circuit with unbypassed emitter resistance explain.

6. Explain the effect of negative feedback on current shunt feedback amplifier derive an expression for A_{if}, A_{vf}, R_{if}, R_{of}.

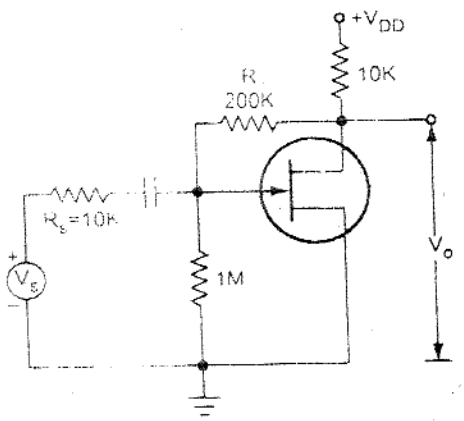
7. For the circuit shown in the figure.
   (a). Identity the topology of feedback with proper reasoning.
   (b). Find A_{if}, A_{vf}, R_{if}, R_{of}, A_i



8. For the feedback amplifier shown in the figure.
   Identity the topology of feedback with proper justification. The transistors used are identical with the following parameters.
   $h_{fe} = 200$, $h_{ie} = 2K$, $h_{re} = 10^{-4}$, $h_{oe} = 10^{-6}$ A/V
   Calculate i) A_{vf} ii) R_{if} iii) R_{of}



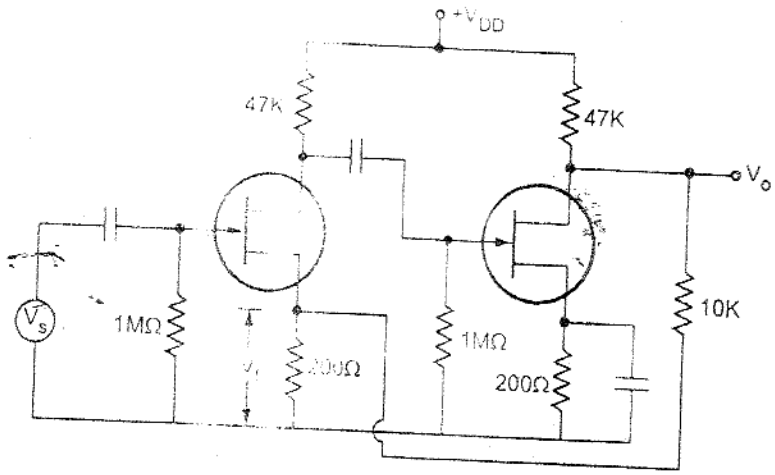
9.In the FET amplifier shown in fig. has the following parameters rd = 40 K g_m = 2.5A/V. Assume all capacitors to be arbitrarily large. Calculate D,R_{Mf}, A_{vf}, R_{if},R_{of} and R'$_{of}$.



10.The two stage feedback shown in fig. uses FET.The parameters are rd = 10 K and μ = 40.

i) Identify the topology of feedback.

ii) Calculate D, A_{vf}, R_{if},R_{of} and R'$_{of}$.


+V_DD
47k
47K
V_o
V_s
1MΩ
1MΩ
200Ω
10K

UNIT II

1. Specify the range of quality factor (Q) for crystal.
2. What are the classifications of Oscillators?
3. Define Barhausen Criterion.
4. What are the types of feedback oscillators?
5. State the conditions for oscillation.
6. Define piezoelectric effect.
7. Draw the equivalent circuit of crystal oscillator.
8. What is the principle of Miller crystal oscillator?
9. State the frequency for RC phase shift oscillator.
10. Define Oscillator
11. Differentiate amplifier and oscillator.
12. What are the advantages of crystal oscillator?
13. Draw the circuit diagram of a twin - T RC oscillator.
14. What is the advantage of a Clapp oscillator over Colpitt's oscillator?
15. What type of feedback is used in oscillators, why?
16. Why a crystal oscillator has a higher degree of frequency stability?
17. What is negative resistance oscillator? Give an example.
18. Distinguish between LC and RC oscillators.
19. Name any two low frequency oscillators.
20. Name any two high frequency oscillators.
21. What is a damped oscillation?
22. What is sustained oscillation?
23. Why it is difficult to have a variable frequency operation in a RC phase shift oscillator?
24. Give expression for frequency of oscillation for colpitts and Hartley oscillator.
25. In an Hartley oscillator, if $L_1 = 0.2$ mH, $L_2 = 0.3$ mH and $C = 0.003$ μF, calculate the frequency of its oscillation.

Part - B

1. With simple diagrams explain the operation of negative resistance oscillator using tunnel diode.
2. Draw the circuit diagram of RC phase shift oscillator and explain its operation.
3. Explain Clapp's oscillator and derive the expression for frequency of oscillation. Also explain

how frequency stability can be improved Clapp's oscillator.

4. Explain Hartley oscillator and derive the equation for oscillation.

5. Explain the resonance frequency of crystal. And draw the pierce crystal oscillator circuit and derive the equation for oscillation?

6.a).Explain with suitable example how logic gates are used as linear amplifier.
b).Explain in brief the Barhausen Criterion for oscillation in feedback oscillator.

7.a).What are the advantages and disadvantages of wein bridge oscillator.
b).Briefly explain the general diagram of LC oscillators with relevant expressions.

8. Draw the circuit diagram of transistorized colpitts oscillator. Obtain the expression for the frequency of operation of colpitts oscillator.

9. With a neat diagram explain Wein-bridge oscillator, and derive the expression for frequency of oscillation.

10. Derive the frequency of oscillation for Twin-T oscillator, and explain its operation with neat circuit diagram.

UNIT III
Part – A

1. What do you mean by Tuned Amplifiers?
2. What is a synchronously Tuned amplifier?
3. Mention the need of Stagger Tuned amplifier.
4. What is meant by Unloaded and Loaded Q of tank circuit.
5. Write a short notes on Coil losses.
6. Define Q.
7. List the advantages and disadvantages of tuned amplifier.
8. What is Neutralization?
9. List the various types of tuned amplifier.
10. What is the effect of Cascading single tuned amplifier on bandwidth.
11. Draw the circuit diagram of class C tuned amplifier?
12. Draw the circuit diagram of a stagger tuned amplifier?
13. . List the various types of neutralization.
14. Draw the equivalent circuit of a single tuned amplifier.
15. How is miller capacitor reflecting on input and output side of a tuned amplifier?
16. Mention the bandwidth of a double tuned amplifier?
17. Point out the different methods of coupling the load to a tuned amplifier?
18. Compare the advantages of double tuned amplifier over single tuned amplifier?
19. Draw the frequency response of single and double tuned amplifier.
20. Mention the applications of Class C tuned amplifier?
21. Write short notes on coil losses in tuned amplifier?
22. What do you understand by instability of tuned amplifiers?
23. Mention some stabilization techniques in tuned amplifiers?
24. Write about the efficiency of Class C tuned amplifier?
25. What is meant by narrowband neutralization?

Part - B

1.With a circuit diagram explain the performance of single tuned inductively coupled amplifier.

2.a).Explain Hazeltine method of neutralization.
b).Brief the principle of Stagger tuning.

3.Explain with circuit diagram the operation of double tuned amplifier.

4.Compare and explain the frequency response of single tuned , double tuned & stagger tuned amplifier.

5.Draw the circuit diagram of a Class-C transistor mixer circuit and describe its operation. List few application of the circuit .

6.a). Explain the concept of stagger tuned amplifier with the help of frequency response
b).Explain Hazeltine neutralization circuit with the help of neat diagram.

7.Derive an expression for tunning frequency of a single tuned amplifier in terms of quality factor and bandwidth of amplifier.

8.What is the effect of cascading a single tuned and double tuned amplifiers on bandwidth?. Derive the expression for it.

9.Explain the various Neutralization techniques.

10.a).Discuss instability of tuned amplifier.
b).Explain the basic mixer circuit with neat diagram.

UNIT IV

Part - A

1. What do you understand by Symmetrical triggering?
2. Why Commutating capacitors are used in bistable Multivibrator?
3. Draw the typical waveform at base and collector of a collector coupled astable multivibrator.
4. What are the applications of Schmitt trigger circuit?
5. What is Bistable multivibrator?
6. State the application of astable multivibrator.
7. What is hysteresis?
8. What is meant by unsymmetrical triggering?
9. Give the difference between ideal and practical emitter coupled astable multivibrator.
10. What is resolving time?
11. What is the function of commutating capacitance in multivibrator?
12. Draw the circuit diagram of a collector coupled astable multivibrator using complementary transistors.
13. Sketch the output wave form of a Schmitt trigger circuit for sine wave input of 12 V peak to peak if UTP=5V and LTP=3V.
14. What is a Schmitt trigger circuit?
15. What are the applications of bistable multivibrator?
16. Why an astablemultivibrator is called as free running oscillator?
17. What is the difference between astable multivibrator and monostable multivibrator?
18. Draw the typical waveforms at base and collector of a collector coupled monostable multivibrator.
19. Define resolving time of bistable multivibrator.
20. Define storage time of multivibrator.
21. Define symmetrical triggering.
22. What is meant by linear wave shaping circuits?
23. Define transition time of bistable multivibrator.
24. What are the applications of Schmitt trigger circuit?
25. What are the triggering methods of multivibrators?

Part - B

1.Describe the circuit diagram of emitter coupled Monostable Multivibrator and explain its operation with relevant waveform.

2.Explain the unsymmetrical and symmetrical triggering of bistable multivibrator.

3.a).Draw the circuit diagram of complementary transistor monostable multivibrator and explain its operation.

b).Explain UTP & LTP of Schmitt triggering.

4.Describe the performance of collector coupled astable multivibrator with relevant diagram.

5.With a neat diagram explain the operation of Schmitt trigger circuit.

6.Derive the expression for the frequency of the emitter coupled astable multivibrator circuit .

7.a).Draw the transfer characteristics of Schmitt trigger and explain what is hysteresis.

b). Write a note on complementary multivibrator circuit.

8.The circuit parameter of a fixed bias bistable multivibrator are $V_{cc}=V_{bb}=5V$, $R_c=1k$, $R_1=5K$, $R_2=2.5K$.The npn silicon transistor used have $(h_{fe})_{min}=20$.Assume all junction voltages to be zero

a).Calculate stable state currents and voltages. verify that one transistor is in saturation and other in cutoff.

b).find the maximum Icbo at which the circuit satisfactorily.

9.a).What is the effect of loading in fixed bias binary? Explain the procedure of calculating heaviest load which binary can derive.

b).Write a note on free running multivibrator.

10.Design a collector coupled monostable multivibrator for following specification:

I_{CBO} and voltage across saturated transistor are negligible.

For transistor $(h_{fe})_{min} = 20$ and base-emitter cut off voltage for transistor normally to be OFF is –1V.The base drive to transistor in saturation is 50% in excess of minimum required. The collector supply ic $V_{cc} = 6V$ and collector current is 2mA.The delay time is 3000μsec. Chose $R_1=R_2$.find R_c,R,V_{BB},R_1 and C

UNIT V

Part A

1. Mention the application of blocking oscillator.
2. How the linearity of current sweep generator can be improved.?
3. Draw the circuit diagram of astable blocking oscillator.
4. Mention the features of Millers saw tooth generator.
5. What is the effect of saturation voltage on pulse width?
6. Define duty cycle.
7. state the condition for high pass RC circuit as a differentiator.
8. Give the features of Millers sweep circuit.
9. Which portion of UJT characteristics is used in UJT saw tooth generator.
10. How linearization is achieved in current time based circuit?
11) Draw the circuit diagram of a free running blocking oscillator?
12) What is a blocking oscillator?
13) What are two types of blocking oscillators?
14) Mention few methods of controlling the pulse.
15) Draw the equivalent circuit of pulse transformer.
16) How is the total pulse of pulse transformer divided?
17) What are the characteristics of diode controlled circuit?
18) What are applications of pulse transformers?
19) Draw the circuit diagram of simple current time base generator.
20) Draw the circuit diagram of an astable blocking oscillator (RC controlled).
21) Draw the monostable blocking oscillator using emitter based timing.
22) What is frequency control using core saturation?
23) Write short notes on push pull operation of astable blocking oscillator?
24) What is meant by linearization using constant current circuit?
25) Where is bootstrap generators used?

Part B

1.Explain with suitable diagram the performance of Monostable blocking oscillator.

2.a).Explain how saw tooth waveform are generated using UJT.
b).Discuss about linearization using constant current source.

3.With a neat diagram explain the operation of Bootstrap circuit .

4.Draw the circuit diagram of monostable transistor blocking oscillator with emitter timing. Explain its operation with equivalent circuit during pulse formation .

5.Explain the basic principles of miller sawtooth generator circuit with the help of neat diagram.

6.Derive the expression for slop error and sawtooth generator speed for bootstrap sawtooth generator circuit.

7.Draw and explain the operation of diode controlled astable blocking oscillator .

8.What is the condition on RL required for the successful operation emitter timing block oscillator.

9.Explain how darlington pair reduces the slop error in bootstrap saw tooth generator circuit.

10.Explain the following methods of controlklinng the pulse width in monostable blocking oscillator

a).core saturation method

b).shorted delay line method.

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

TRANSMISSION LINES AND WAVE GUIDES
(COMMON TO ECE & ETCE)

PROGRAM/ BRANCH: BE / ECE YEAR/ SEM : III/ V

QUESTION BANK

UNIT I
PART A

1. Define neper & bel.
2. Define decibel.
3. What is filter?
4. What are the types of filter?
5. What is symmetrical networks?
6. Write the equivalent value of neper to decibel?
7. What are the parameter of filter?
8. How will you construct band pass filter by using LPF & HPF?
9. How will you construct band stop filter by using LPF & HPF?
10. What is cut off frequencies?
11. Define characteristics impedance.
12. What is propagation constant?
13. What is constant k low pass filter?
14. What are the types of constant k filter?
15. What is low pass filter?
16. Write a short notes on m derived filter?
17. What are the disadvantage of constant k filter?
18. Draw the diagram of symmetrical T-network of LPF?
19. Draw the circuit diagram of band elimination filter of m derived filter?
20. What is crystal filter?
21. Design a ladder network formed by symmetrical T-network?
22. Write a relationship between propagation constant in terms of Zo.
23. Define composite filter.
24. Draw the general configuration of constant k LPF?
25. Draw the variation of attenuation α & β with frequency in constant k LPF & HPF?

PART B

1. Explain the characteristics impedance of symmetrical network.

2. Develop the differential equations governing the voltage and current at any point on a uniform transmission line, and then solve these to obtain the voltage and current in terms of the load current and voltage.

3. Design a low pass filter (both T & Π) having cut off frequency 1 KHZ to
   i) Operate with a terminated load resistance of 200□
   ii) Find the frequency at which this filter offers attenuation of 19.1 db.

4. Explain about filter fundamentals.
5. Explain about behavior of the characteristics impedance.
6. What is constant k filter? & derive the expressions for LPF.
7. i) Design a constant k BPF with fc of 3khz & 7.5 khz & nominal characteristics impedance or Ro=900□
   ii) design a constant BSF with fc of 3khz & 7.5 khz & nominal characteristics impedance or Ro=900□

8. Explain about m derived filter of T & Π sections.
9. Explain about filter performance.
10. What is crystal filter & explain it.

UNIT II
PART A

1. What is transmission line?
2. What are the types of transmission lines?
3. What are the parameters of transmission lines?
4. Define Propagation constant.
5. What is a finite line? Write down the significance of this line?
6. Give the properties of infinite lines.
7. What are the types of line distortions?
8. How to avoid the frequency distortion that occurs in the line?
9. What is a distortion less line? What is the condition for a distortion less line?
10. What is the drawback of using ordinary telephone cables?
11. What is loading?
12. Define reflection coefficient.
13. What is a smooth line?
14. List the parameters of a transmission line
15. State the conditions for a distortion less line.
16. What are the disadvantages of parallel open wire line?
17. What is the principle of reflection phenomenon?
18. Define wave length.
19. Define velocity.
20. Why is waveform distorted in transmission line?
21. A transmission line with a characteristic resistance of 50 ohm is connected to a 100-ohm resistance load. Calculate the voltage reflection coefficient at the load.

22. Mention the characteristics of an infinite line.
23. What are the practical considerations of underground cable?
24. Discuss briefly about loading in Telephone cable.
25. What is return loss?

PART B

1. i) Explain physical significance of a general solution of transmission line.(6)
   ii) Describe the expression of a line not terminated in Z_0. (6)
2. A generator of 1 V, 1 KHz supplies power to a 100 km open wire line terminated in 200 Ω resistance. The line parameters are R = 10 Ω/ Km, L = 3.8 mH / Km, G = 1 x 10^{-6} mho/ Km, C = 0.0085 uF/ Km. Calculate the input impedance, reflection coefficient and sending end current.
3. Derive the general solution of transmission lines.
4. i) Show that a line will be distortion less if CR = LG. (6)
   ii) A transmission line has the following per unit length parameters R = 52 Ohm/m, L = 0.1 uH / m, C = 300 pF / m, G = 0.01 mho/m(6) Calculate the propagation constant and characteristics impedance of transmission line at 500 MHz; obtain the same parameters for loss less line.
5. Derive the expression for the insertion loss of transmission line.(5)
   ii) A transmission line has $Z_0 = 70\angle -13.4^\circ$ ohm is inserted between a generator of 200 ohm and a load of 400 ohm. The attenuation and phase constant of the line is α = 0.00712 neper / Km and β = 0.0288 rad / Km. Calculate the insertion loss if the length is 200 Km. (7)
6. What is distortion line? Explain its types.
7. A transmission line of 2 miles long operates at 10 kHz and has parameters R=30 Ω/mile, L=2.2mH/mile, C=80nF/mile and G=20nV/mile. Find the characteristic impedance, propagation constant, attenuation and phase shift per mile.
8. i) Explain a line of cascaded T sections
   ii) Reflection on a line is not terminated in Zo.
9. Give expressions for open & short circuited lines.
10. Explain about telephone cable

UNIT III

PART A

1. State the assumptions for the analysis of the performance of the radio frequency line.
2. What are nodes and antinodes on a line?
3. What is standing wave?
4. What is the range of values of standing wave ratio?
5. What is called standing wave ratio?
6. Give the input impedance of dissipationless line.
7. What is the application of the quarter wave matching section?
8. Explain impedance matching using stub.
9. Give the formula to calculate the length of the short circuited stub.
10. List the applications of the smith chart.

11. Write a note on smith chart.
12. What are the difficulties in single stub matching?
13. Give reason for an open line not frequently employed for impedance matching.
14. Why Double stub matching is preferred over single stub matching?
15. A 50 ohm line is terminated in load Z_R (90+j60). Determine VSWR due to this load.
16. Derive the expression for the voltage at a point S away from the receiving end interms of reflection coefficient.
17. A line with characteristic impedance of 692∟-12° is terminated with 200 ohm resister. Determine K.
18. Write a note on quarter wave line.
19. A certain transmission line, working at ratio frequencies, has following constants L=9μH/m, C-16pf/m. the line is terminated in a resistive load of 1000□. Find the reflection coefficient and standing wave ratio.
20. What is dissipation less line.
21. Calculate the standing wave ratio and reflection co efficient on a line having Zo=300□ and terminated in ZR=300 + j 400.
22. What is resonant lines.
23. Write the properties of smith chart.
24. What is a application of half wave line.
25. What is zero dissipation line?

PART B

1. Discuss how a smith chart is constructed and explain its applications.
2. Explain the following:
   i) Single stub matching. (8)
   ii) Double stub matching.(4)
3. Derive the expression of circle diagram for the transmission line.
4. Explain about voltage & current on a dissipation less line.
5. What is standing wave ratio & give relation between SWR (S) & magnitude of reflection coefficient (K).
6. A dipole antenna whose input impedance is 100 ohm is to be matched at frequency of 100 MHz to a transmission lines having Z_o of 600 ohm by means of short circuit stub. Determine the location and length of the stub.
7. Determine the SWR, characteristic impedance of the quarter wave transformer, and the distance the transformer must be placed from the load to match a75 ohm , transmission line to load Z_L=25-j50 ohm.
8. Determine the input impedance of open and short circuited dissipationless transmission line.
9. Explain about one eighth wave line and quarter wave line.
10. Define and explain the following
    i) Standing waves (4)
    ii) Standing wave ratio(4)
    iii)Relation between SWR and 'K'.(4)

UNIT IV
PART A

1. What are guided waves? Give examples.
2. What is cut off frequency?
3. Write down the expression for cut off frequency when the wave is propagated in between two parallel plates.
4. Give the expressions for the guide wavelength when the wave is transmitted in between two parallel plates.
5. Mention the characteristics of TEM waves.
6. Define attenuation factor.
7. What is dominant mode? Give examples.
8. What is TE wave?
9. What is TM wave?
10. Give the relation between the attenuation factor for TE waves and TM waves
11. Why are rectangular wave-guides preferred over circular wave-guides?
12. Mention the applications of wave guides.
13. What is a TEM wave or principal wave?
14. What is TM wave or E wave?
15. What is the boundary conditions of TEmn wave in rectangular wave guide?
16. Distinguish TE wave and TM wave?
17. Give the dominant mode for TE and TM waves
18. Mention the characteristics of TEM waves.
19. What is attenuation constant in terms of propagation?
20. Define characteristic impedance in a waveguide.
21. Draw the neat sketch showing the variation in the value of attenuation with frequency for TE,TM,TEM mode between parallel plates.
22. Find the frequency of minimum attenuation for TM mode.
23. Define group velocity and phase velocity
24. For a frequency of 6000 MHz and plane separation of 7 cm, find critical wavelength.
25. What is attenuation for TEM wave.

PART B

1. Derive the electromagnetic field expressions for waves guided by a parallel conducting plane?
2. (i) Bring out the differences between TE,TM and TEM waves.(9)
   (ii) Find the cut-off frequency for the TE_1 mode for the frequency of 8000 MHz and plane separated by10 cm.(7)
3. Define wave impedance. Obtain the expression for wave impedance of TE, TM and TEM waves in two parallel conducting planes.
4. Explain about the velocity propagation of guided waves..
5. Derive the expressions for the field components of TM waves in a parallel plane waveguide.
6. i) what are the properties of TEM waves

ii) a pair of perfectly conducting planes are separated 4 cm in air. For a frequency of 5000 MHZ with TM1 mode find following,

a) cut off frequency b) cut off wavelength c) phase constant.

7. For the frequency of 6000 MHz and plane separation of 7 cm, find the following for TE_1 mode.
   i) Critical frequency (3)
   ii) Phase constant (3)
   iii) Attenuation constant(3)
   iv) Critical wavelength.(3)
8. i) Write different characteristics of TE and TM waves.
   iii) Attenuation in parallel plane guides
9. i) what is TE & TM waves

   ii) A parallel plane wave guide consists of two sheets of good conductor separated by 10cm. find the propagation constant at frequencies of 100 MHz and 10MHZ when the guide is operated in TE10 mode. Does the propagation take place in each area.
10. i) what is TEM waves?
    ii) characteristics of TE& TM waves.

UNIT V
PART A

1. What are waveguide?
2. What consists of wave guide?
3. Draw the field distribution in TM wave in rectangular wave guide.
4. Write the boundary condition for the rectangular waveguide in rectangular co ordinate system (TM wave).
5. What is boundary condition of TE in wave in rectangular wave guide?
6. What is meant by dominant mode of the wave?
7. State the reason of impossibilities of TEM wave in wave guide.
8. Write the assumptions to be taken for analysis of rectangular wave guide in TE & TM modes?
9. What are the boundary conditions for the TE wave?
10. Which are non zero field components for the TE10 mode in a rectangular wave guide?
11. Which are non zero field components for the TM11 mode in a rectangular wave guide?
12. How the modes of the transverse electric and magnetic waves are represented?
13. What is the cut off wavelength & cut off frequency of the TE10 mode in a rectangular wave guide?
14. What is the cut off wavelength & cut off frequency of the TM11 mode in a rectangular wave guide?
15. What are the root values for the TE modes?
16. Explain why TM01 & TM10 modes in a rectangular waveguides do not exist.

17. Draw the neat sketch showing the variation of attenuation with frequency for TE & TM waves in a wave guide.
18. Why the TE10 wave is called as dominant wave in rectangular wave guide?
19. Write the note on excitation of waveguides.
20. Draw the field patterns for the dominant mode of TE_{mm} wave in the circular waveguide.
21. Which is the most dominant mode in rectangular waveguide? Why?
22. *What is the* Bessel's function?
23. Write a short notes on guide termination.
24. What is the cut off frequency of TM wave?
25. What is cavity resonator?

PART B

1. Explain about applications of Maxwells equations to the rectangular wave guides?
2. Derive the expressions for the field components of TE waves in a rectangular waveguide.
3. Explain about the various TEmn Modes and dominant TEmn mode in rectangular wave guide
4. A rectangular wave guide resonator of cross sectional dimensions 2.2cm*1 cm is filled with air. What should be the length of resonator for TE101 mode resonance at 10 GHZ? What is the next higher mode of resonance and the corresponding resonant frequency?
5. Explain the characteristic impedance of a rectangular waveguide and derive the expression for TE, TM and TEM waves.
6. An air filled rectangular wave guide of inside dimensions 7 * 3.5 cm operates in the dominant TE 10 mode.
   i) Find the cut off frequency
   ii) Determine the phase velocity at a frequency of 3.5 GHZ.
   iii) Determine the guide wavelength at a frequency of 3.5 GHZ.
7. Design a rectangular wave guide with the following specifications
   i) At a 7.5GHZ the guide wavelength for TE10 modes is 90% of the cut off wave length.
   ii) TE30 & TE12 have the same cut off frequency.
8. Derive the expression for attenuation for TM11 waves in rectangular wave guide.
9. Explain how various modes can be excited in a rectangular wave guide.
10. Explain about resonant cavity?

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QUESTION BANK

SUBJECT: LIC & IT'S APPLICATIONS
CLASS/SEM/DEPT: III YEAR / V SEM / ECE (COMMON TO ECE & ETCE)

UNIT I

PART A

1. Define an operational amplifier.
2. Mention the characteristics of an ideal op-amp.
3. What happens when the common terminal of V^+ and V^- sources is not grounded?
4. Define input offset voltage.
5. Define input offset current. State the reasons for the offset currents at the input of the op-amp.
6. Define CMRR of an op-amp.
7. What are the applications of current sources?
8. Justify the reasons for using current sources in integrated circuits.
9. What is the advantage of widlar current source over constant current source?
10. Define slew rate. What does it signify
11. Draw a neat sketch showing the frequency response of op-amp 741 .
12. What is frequency compensation.
13. What is differential amplifier and list the types.
14. Define Linear IC. State its advantages.
15. Differentiate linear IC from Digital ICs.
16. Define Current Source.
17. Draw the internal Block of an Op-Amp.
18. What are the Different Linear IC packages?
19. Why is R_E is replaced by a constant current bias circuit in a Difference Amplifier?
20. What is the advantage of using Active load in Difference Amplifier?
21. Compare Constant Current bias and Current mirror Methods.
22. What are the Techniques available to compensate the Variation in CMRR?
23. What are the advantages of Band gap Reference Circuit?
24. List the types of Frequency Techniques Available.
25. What are the causes of Slew Rate?

PART B

1. Explain the working of a Current Source with a circuit diagram.
2. Explain the operation of a basic differential amplifier.
3. Draw the circuit diagram of a symmetrical emitter coupled difference amplifier and show that a very high CMRR will result if the difference amplifier is supplied by a constant current bias.
4. Draw and explain the circuit diagram of a basic current mirror and improved current mirror circuit.
5. a)What are the ideal characteristics of Op-amp
   b) Explain band gap reference circuit
6. Explain the frequency compensation Techniques used in operational amplifiers.
7. Explain the differential amplifier circuit with active load to improve Common mode gain.
8. Explain in detail Widlar Current Source.

9. Explain supply independent biasing using zener referenced bias circuit.
10. Draw and explain in detail about Slew rate and methods of improving slew rate.

UNIT II

PART A

1. Mention two characteristics of Instrumentation Amplifier.
2. Mention two applications of Schmitt Trigger.
3. State the disadvantages of passive filters.
4. Draw an integrator circuit using op-amp .
5. Write the advantages of active filter over passive filter.
6. Draw the circuit diagram of full wave precision rectifier.
7. What are the areas of application of non-linear op-amps circuits?
8. What are the limitations of the basic differentiator circuit?
9. Derive the gain of an op-amp Buffer.
10. What are AF and RF op-amp Oscillators? Give examples.
11. What is an Op-amp Buffer? State its advantages.
12. Draw the differentiator circuit using Op-Amp.
13. Draw and mention the equation for Non-inverting summing amplifier.
14. Draw and mention the equation for Adder- Subtractor circuit using Op-Amp.
15. Mention some of the linear applications of op -- amps
16. Mention some of the non – linear applications of op-amps
17. What are the applications of V-I converter?
18. What do you mean by a precision diode?
19. Write down the applications of precision diode.
20. List the applications of Log amplifiers
21. Draw the Inverting and Non Inverting Amplifier Circuits.
22. What is Multivibrator and list its types.
23. Draw the Circuit of a full wave rectifier.
24. Write the expression for Log and Anti Log Amplifier.
25. Differentiate between astable and monostable Multivibrator.

PART B

1. Explain the working principle of RC phase shift oscillator with neat sketch.
2. Explain the working of:
   i. Schmitt trigger
   ii. Comparator
3. Derive the Closed Loop voltage gain equation for Inverting and Non Inverting Amplifier.
4. Explain the working of
   (i) Voltage to Current Converter
   (ii) Triangular Wave Generator
5. Explain Instrumentation Amplifier with a neat diagram and derive its gain.
6. Discuss in detail the operation of Astable Multivibrator.
7. Discuss in detail the operation of Monostable Multivibrator.
8. Explain the following op amp applications with a neat circuit diagram and derivations:
   (i) Integrator
   (ii) Differentiator
9. Draw a neat Op-Amp Low pass Butterworth filter and derive the design equations.
10. A) Derive an expression for the output voltage of op-amp anti-log amplifier.
    B) Derive an expression for the output voltage of op-amp log amplifier.

UNIT III
PART A

1. What is amplitude modulation.
2. Define lock range
3. What is a two quadrant multiplier.
4. With reference to a VCO, define voltage to frequency conversion factor K_v.
5. What is a four quadrant multiplier.
6. Define capture range of a PLL.
7. Name two applications of PLL.
8. What is a voltage controlled oscillator.
9. Define Compander and its purpose.
10. Mention some areas where PLL is widely used.
11. Define Lock-in range of a PLL.
12. Compare the features of digital multiplier with analog multiplier.
13. List down the important electrical characteristics of 565 PLL.
14. Draw a neat block diagram of VCO.
15. What are the advantages of Compander IC.
16. List the basic building blocks of PLL
17. What are the three stages through which PLL operates?
18. Give the classification of phase detector
19. What is a switch type phase detector?
20. What are the problems associated with switch type phase detector?
21. What is a voltage controlled oscillator?
22. Discuss the effect of having large capture range.
23. List the Applications of VCO.
24. Mention the Advantages of Frequency Synthesizers in Integrator Circuits.
25. Draw FSK De-Modulator circuit using IC565.

PART B

1. Briefly explain the block diagram of PLL and derive the expression for Lock range and capture range.
2. With a neat functional diagram, explain the operation of VCO. Also derive an expression for f_0.
3. Analyze the Gilbert's four quadrant multiplier cell with a neat circuit diagram. Discuss its applications.
4. Briefly discuss the applications of PLL
5. Explain AM modulator and demodulator
6. Explain PM modulator and demodulator
7. Explain FSK modulator and demodulator
8. Explain frequency synthesizers with a neat Diagram.
9. Analyze the variable transconductance multiplier with a neat circuit diagram. Discuss its applications.
10. Compare PM, AM and FSK modulators.

UNIT IV
PART A

1. What is Sample and Hold Circuit?
2. What is Digital to Analog converter and Classify it.
3. How many comparators are required to build an n bit flash type A/D converter.
4. Why is the R-2R ladder network DAC better than weighted resistor DAC.
5. Which type of ADC is used in all digital voltmeters.
6. Define monotonicity with respect to D/A converter.
7. List the Applications of Sample and Hold Circuits.
8. Define Settling time of DAC.
9. What is granular noise.
10. List advantages of ADM.
11. Explain in brief the principle of operation of successive approximation ADC.
12. Mention the Advantages of sample and hold circuit.
13. Which is the simplest DAC? Why?
14. Why MOSFET is used in Op-amp Sample and Hold circuit.
15. What are the parameters of ADC and DAC? List them.
16. What is Delta Modulation?
17. Classify Different types of Voltage to frequency converters.
18. Compare Single slope and Dual slope converters.
19. List out some integrating type converters.
20. What is integrating type converter?
21. Define conversion time.
22. Define accuracy of converter.
23. Give some specification for Voltage to frequency converter.
24. Define Offset Error and Linearity Error.
25. Define Quantization Error.

PART-B

1. What is integrating type converter? Explain the operation of dual slope ADC
2. Explain the principle of operation of successive Approximation ADC.
3. With neat sketch explain the operation of sample and hold circuit.
4. Explain the various types of digital to analog converters.
5. What is delta sigma modulation? Explain the A/D conversion using Delta modulator
6. Explain delta modulation with neat diagram.
7. Explain flash type ADC with diagram.
8. Draw and explain voltage to time and Voltage to frequency converters.
9. Explain in detail about various analog switches.
10. Explain Binary weighted resistor DAC

UNIT V

PART A

1. Name a timer IC and a voltage regulator IC.
2. Define ripple rejection with respect to voltage regulators.
3. Why is that a switching regulator has a higher efficiency than a series regulator.
4. What is the roll off rate for a third order low pass filter.
5. Name the two packages in which IC 555 timer is available.
6. Why do switching regulators have better efficiency than the series regulators.
7. Define line regulation.
8. What is noise.
9. What is shot noise.
10. List the main features of timer IC 555.
11. Draw the PIN Diagram of IC 555 Timer.
12. What is an Isolation amplifier.
13. Define voltage regulation. Calculate its percentage for an ideal voltage regulator.
14. What are the types of noises that are introduced in op amp.
15. What is Linear mode power supply?
16. What is an optocoupler? State its advantages.
17. List the application of Astable multivibrator using IC 555.
18. Define duty Cycle.
19. What is tuned amplifier?
20. Mention the characteristics of voltage Regulator.
21. Classify the types of voltage regulator.
22. List the advantages of Switched capacitor.
23. What is an power amplifier and classify its types.
24. Draw the waveform of Class C Amplifier.
25. Draw the block diagram of fiber optic network.

PART-B

1. What is 555 timer? What are the features of 555 timer? Explain the monostable mode in detail?
2. Explain the Astable mode of operation using 555 timer.
3. Explain in detail about Class A and Class B Power Amplifiers.
4. Explain in detail the 723 IC general purpose voltage regulator.
5. Draw and explain the operation of switching regulators. Give its advantages.
6. Explain the functional diagram of LM 380 power amplifier.
7. Explain tuned amplifier with neat diagram.
8. Briefly discuss in detail about video amplifier with neat sketch.
9. Explain opto-coupler in detail.
10. With neat diagram explain isolation amplifier.

VINAYAKA MISSION'S UNIVERSITY

V.M.K.V ENGINEERING COLLEGE, SALEM

DEPARTMENT OF ELECTRONICS & COMMUNICATION

V SEMESTER

INFORMATION THEORY AND CODING
(COMMON TO ECE, ETCE & IT)

QUESTION BANK

UNIT -1

PART - A

1. Define Entropy.
2. Define Self-Information.
3. State the Properties of Entropy Function.
4. State the Condition for entropy to be maximum.
5. Define Joint entropies.
6. Define Conditional entropies.
7. Define Equivocation.
8. State the significance of H(Y/X) and H(X/Y).
9. Define entropy in the continuous case function.
10. State the properties of continuous entropy function.
11. Define mutual information.
12. What is Kraft inequality?
13. Define efficiency of coding.
14. What is purpose of coding?
15. Define the terms encoding and decoding.
16. What do you mean by uniquely decipherable encoding?
17. Define redundancy of coding.
18. What are instantaneous codes?
19. Define average length of a code.
20. State the properties of mutual information.

21. Prove any one property of mutual information.

22. Prove any one property of entropy.

23. State the properties of information rate.

24.find the entropy of an event of throwing a die.

25. a discrete source emits 3000 symbols once every second. The symbol probabilities are {0.5, 0.2, 0.15, 0.1, 0.05} respectively. Determine source entropy and information rate.

PART B

1. What is Entropy? Explain the properties and types of Entropy?
2. Explain about the relationship between Joint and Conditional Entropy.
3. The Joint Probability Matrix is given as

$$\begin{bmatrix} 0.3 & 0.05 & 0 \\ 0 & 0.25 & 0 \\ 0 & 0.15 & 0.05 \\ 0 & 0.05 & 0.15 \end{bmatrix}$$

Find all the Entropies and Mutual Information.

4 Prove that the Upper bound on Entropy is given as $H_{max} \leq \log_2 M$. Here 'M' is the number of messages emitted by the source.

5. Prove that $H(X,Y)=H(X/Y)+H(Y)$

$$=H(Y/X)+H(X)$$

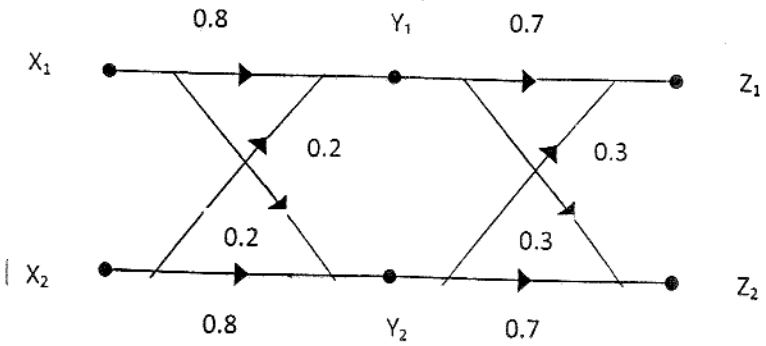
6. (i) A channel has the following Channel matrix.

$$\mathbf{P(Y/X)} = \begin{bmatrix} 1-P & P & 0 \\ 0 & P & 1-P \end{bmatrix}$$

(a)Draw the Channel diagram.

(b)If the source has equally likely outputs, Compute the probabilities associated with the channel outputs for P=0.2 (6 marks)

(ii)Two BSC's are connected in cascade as shown in the figure.



(a)Find the Channel Matrix of the resultant channel.

(b)Find P (Z_1) and P (Z_2), if $P(X_1) = 0.6$, $P(X_2) = 0.4$

7. (i)Prove that the Mutual information of the channel is Symmetric.

$$I(X, Y) = I(Y, X)$$ (6 marks)

(ii)Prove that the mutual information is always positive

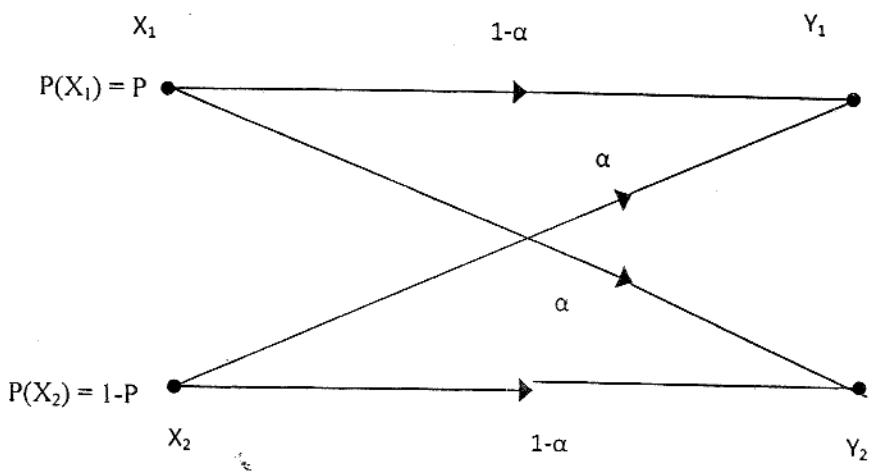
$$I(X, Y) \geq 0$$ (6marks)

8.Prove the following relationships:

a) I(X,Y)=H(X)-H(X/Y)

b) I(X,Y)=H(Y)-H(Y/X)

9.(i) Consider the Binary Symmetric Channel shown in the figure.

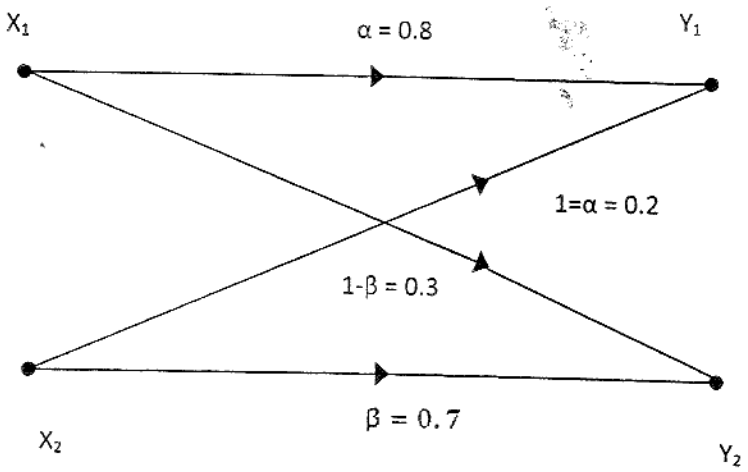


Calculate H(X),H(Y),H(Y/X) and I(X,Y)

(ii)Prove the following

I(X,Y)=H(X)+H(Y)-H(X,Y)

10. (a)Find the Mutual Information and Channel capacity for the channel shown in the figure. Given that $P(X_1) = 0.6$ and $P(X_2) = 0.4$ (6 Marks)



(b)A Binary Channel Matrix is given as:

$$\begin{bmatrix} \frac{2}{3} & \frac{1}{3} \\ \frac{1}{10} & \frac{9}{10} \end{bmatrix}$$

Determine H(X), H(X/Y), H(Y/X) and Mutual Information I(X, Y).

UNIT - 2

PART A

1. What do you mean by memoryless channel?
2. Define a discrete channel.
3. When is a discrete channel said to be memoryless?
4. Define channel matrix D.
5. Distinguish b/w noisy reception & perfect reception.
6. Name the different types of channels.
7. What is a lossless channel?
8. Define a deterministic channel.

9. What is a noiseless channel?

10. When is a channel said to be useless?

11. Define a symmetric channel?

12. Define channel Capacity.

13. What do you understand by BSC and BEC.

14. What is the channel capacity of lossless channel?

15. What is the channel capacity of deterministic channel?

16. What is the channel capacity of noiseless channel?

17. What is the channel capacity of symmetric channel?

18. Define shannon's fundamental theorem?

19. What is decoding schemes?

20. What is useless channel?

21. What is the channel capacity of unsymmetric channel?

22. Define ideal observer.

23. Define fano's inequality.

24. Define maximum likelihood decision scheme.

25. Calculate the capacity of lowpass channel with a usable bandwidth of 3000Hz and S/N = 10^3 at the channel output. Assume the channel noise to be Gaussian and white.

PART-B

1. Explain in detail about Discrete Memory less Channel.

2. Explain the Different types of Channels and Channel Capacity.

3. State and Explain Shannon Hartley theorem.

4. Write Short notes on

i) Decoding Schemes.

ii) Write short notes on Shannon's fundamental theorem.

5. a).Explain in details about Fanon's inequality.

b. Determine the capacity of a ternary channel with the stochastic matrix

$$[p] = \begin{bmatrix} \alpha & 1-\alpha & 0 \\ \frac{1}{2} & 0 & \frac{1}{2} \\ 0 & 1-\alpha & \alpha \end{bmatrix}, 0 \le \alpha \le 1$$

6. Derive the expression for the capacity band limited Gaussian channel

7. A Zero Memory source contains X={x1, x2, x3, x4} with

D(X) = {1/2, 1/4, 1/8, 1/8}

i) Determine entropy of the source

ii) Determine the second order extension of the source and show that $H(X^2) = 2H(X)$

8. Find the capacity of the following three binary channels, given below

a) $P_{11}=P_{22}=1$

b) $P_{11}=P_{12}=P_{21}=P_{22}=1/2$

c) $P_{11}=P_{12}=1/2$; $P_{21}=1/4$; $P_{22}=3/4$

9. i) Find the capacity of the channel with the noise matrix as shown below:

$$\begin{bmatrix} \frac{1}{2} & \frac{1}{4} & 0 & \frac{1}{4} \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ \frac{1}{4} & 0 & \frac{1}{4} & \frac{1}{2} \end{bmatrix}$$

ii) Derive the expression for channel capacity of a symmetric noise characteristic channel. From the above expression calculate the channel capacity of the given channel noise matrix

$$\begin{bmatrix} P & 1-P & 0 & 0 \\ 0 & P & 1-P & 0 \\ 0 & 1-P & P & 0 \\ 0 & 0 & 1-P & P \end{bmatrix}$$

10. i) Evaluate the channel capacity of the channel whose matrix is given to be

$$\begin{bmatrix} \frac{1-p}{2} & \frac{1-p}{2} & \frac{p}{2} & \frac{p}{2} \\ \frac{p}{2} & \frac{p}{2} & \frac{1-p}{2} & \frac{1-p}{2} \end{bmatrix}$$

ii) a. Evaluate the capacity of the channel whose matrix is given as

$$\begin{bmatrix} 1-\beta & \beta & 0 \\ \beta & 1-\beta & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

b. Determine the capacity of a ternary channel with the stochastic matrix

$$[p] = \begin{bmatrix} \alpha & 1-\alpha & 0 \\ \frac{1}{2} & 0 & \frac{1}{2} \\ 0 & 1-\alpha & \alpha \end{bmatrix}, 0 \le \alpha \le 1$$

UNIT III

PART A

1) State information capacity theorem

2) Define differential entropy.

3) Define Shannon limit

4) State Channel coding theorem.

5) Define rate distortion function

6) What is the need for data compression?

7) What are the drawbacks of data compression?

8) Differentiate lossless and lossy compression

9) Define entropy coding

10) What is runlength coding?

11) Define statistical encoding

12) What is differential encoding?

13) Define transform encoding

14) Define data compaction

15) What is prefix coding?

16)what is the need for audio compression?

17)what is the principle of audio coding?

18)what is the need for video compression?

19)write short notes on video compression technique.

20)define rate distortion theory.

21)what is lossless compression?

22) determine the rate of the sampler to digitize an analog signal which has a banwidth of 5hz through to 15Hz.

23)determine the memory required to store a 15-minute passage of speech signal.

24)what is MPEG?

25)define the capacity of colored noise channel.

PART B

1) State and explain information capacity theorem

2) Explain the implications of information capacity theorem

3)Alphanumeric data are entered into a computer from a remote terminal through a Voice grade telephone channel. The channel has a bandwidth of 3.4khz and output signal-to-noise ratio of 20db.The terminal has a total of 128 symbols.Assume that the symbols are equiprobable and the successive transmissions are statistically independent. Calculate the information capacity of the Channel , and the maximum symbol rate for which error free transmisssion over the channel is possible.

4)A voice grade channel of telephone network has a bandwidth of 3.4khz. Calculate the information capacity of the telephone channel for a signal to noise ratio of 30db and the minimum signal – to – noise ratio required to support information transmission through the telephone channel at the rate of 9.6kb/s.

5)An analog signal having 4khz bandwidth is sampled at 1.25 times the Nyquist rate and each sample is quantized into one of 256 equally likely levels.Assume that the successive samples are statistically independent.

(i) What is the information rate of this source ?

(ii) Can the output of the source be transmitted without error an AWGN channel with a bandwidth of 10khz and an S/N ratio of 20db ?

(iii) Find the bandwidth required for an Awgn channel for error-free transmission of the output of this source if the S/N ratio is 25db.

5) Explain rate distortion theory

6) Explain data compression

7) Explain data compaction

8)with the aid of a block diagram explain how digitized pictures are compressed.

9)describe the operation of JPEG decoding stage with a block diagram.

10).list out the compression techniques. Explain any one in detail.

UNIT IV

PART A

1) What are linear codes?

2) What are error correcting codes?

3) What are the properties of syndrome?

4) Define hamming distance

5) What are error correcting codes?

6) What are repetition codes?

7) What are cyclic codes?

8) What are golay codes?

9) What are the advantages and disadvantages of cyclic codes?

10) Consider the (15,9) cyclic code generated by $G(p) = p^6+p^5+p^4+p^3+1$. This code has a burst error correcting ability of q=3. Find the burst error correcting efficiency of this code.

11) Define Convolutional coding.

12) Define code rate of Convolutional encoder.

13) Define constraint length of a convolution code.

14) Compare code tree and trellis diagram

15) What are turbo codes?

16) What are BCH codes?

17) What are RS codes?

18)what is meant by systematic and nonsystematic codes?

19)define code efficiency?

20)what are the important terms of error control coding?

21)define forward acting error correcting?

22)what is meant by channel data rate?

23) what are all the methods of error correcting?

24) give one example of error control coding.

25)give any two properties of cyclic codes.

PART B

1) The generator matrix for a (6,3) block code is given below. Find all the code vectors of this code.

$$G = \left|\begin{array}{ccc:ccc} 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 \end{array}\right|$$

2) Considering (7,4) Code defined by generator polynomial $g(x)=1+x+x^3$ the codeword 0111001 is sent over a noisy Channel producing a received word 0101001 that has a single error. Determine Syndrome Polynomial S(x) and error polynomial e(x).

3) For a (6,3) systematic linear block code, the three parity check bits c_4,c_5,c_6 are formed from the following equations

$C_4 = d1+d3$; $C_5 = d1+d2+d3$; $C_6 = d1+d2$

i) Write down the generator matrix

ii) Construct all possible codewords

iii) Suppose that the received word is 01011.Decode this received word by finding the location of the error and the transmitted data bits.

4)Construct a Convolutional encoder for the following specifications:

Rate efficiency = ½, Constraint length = 4.

The connection from the shift registers to modulo-2 adders are described by the following equations:

$g_1(x) = 1+x$; $g_2(x) = x$

Determine the output codeword for the input message 1110.

5) A generator matrix of (6, 3) linear block code is given as

$$G = \left|\begin{array}{ccc:ccc} 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 \end{array}\right|$$

Determine the d_{min} for the above code. Comment on error correction and detection capabilities. If the received sequence is 1 0 1 1 0 1 , determine the message bit sequence.

6) How is syndrome calculated in cyclic codes?

7) Explain the Viterbi Algorithm with an example

8) The generator polynomial of a (7, 4) cyclic code is $G(p) = p^3 + p + 1$. Find all the code vectors for the code in non systematic form.

9) The generator polynomial of a (7, 4) cyclic code is $G(p) = p^3 + p + 1$. Find all the code vectors for the code in the systematic form.

10) Construct a convolutional encoder whose constraint length (k) is 3 and has modulo-2 adders and an multiplexer. The generator sequences of the encoder are:

$$g^1=(1,0,1);\ g^2=(1,1,0);g^3=(1,1,1)$$

find the encoder output produced by the message sequence 10111.....verify the code word using algorithm.

UNIT V

PART A

1) List the methods for decoding of Convolution codes.
2) Define metric
3) What is surviving path?
4) Define free distance
5) Define coding gain.
6) Give the probability of error with soft decision decoding
7) Give the probability of error with hard decision decoding.
8) Define Noise channel Model
9) Explain Maximum Likelihood Receiver?
10) List out the Characteristics of Viterbi Algorithm
11) List out the practical applications of Viterbi Decoding
12) What is meant by Viterbi Decoding?
13) What is the advantage of Viterbi Decoding?
14) Why Viterbi Algorithm needed?
15) What is meant by forward error correction?
16) Define traceback method of Viterbi Decoding
17) Define the concept of Likelihood
18) List out the Properties of Maximum Likelihood Receiver
19) List out the applications of Maximum Likelihood estimation.
20) Write the expression for Maximum Likelihood Receiver?

21) Define normal distribution.

22) Where convolutional codes are used?

23) How polynomials are selected?

24) Draw the structure of rate-1/2 feed forward convolutional encoder

25) What is meant by path matrix?

PART B

1) Explain Viterbi algorithm for decoding of Convolutional codes

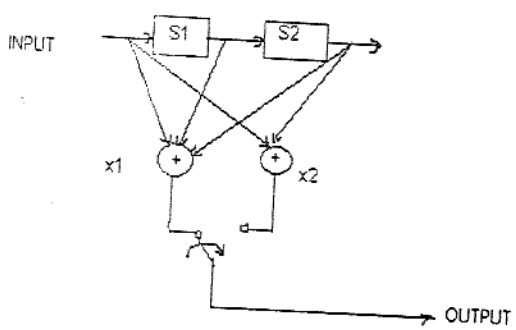
2) Explain sequential decoding for Convolutional codes.

3) Derive the probability of errors for soft and hard decision decoding.

4) Compare hard decision decoding and soft decision decoding

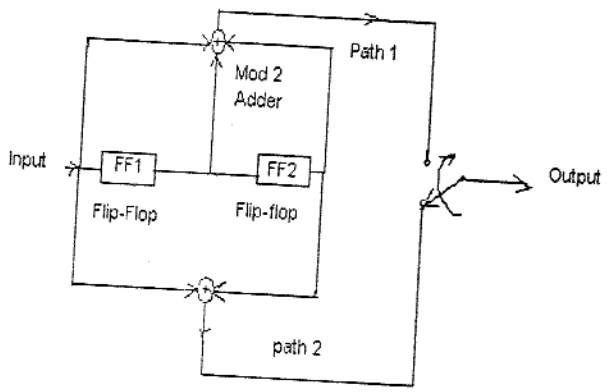
5) An encoder shown below generates an all zero sequence which is sent over a binary symmetric channel. The received sequence 0100100.... There are two errors in this sequence at 2nd and 5th positions. Show that this double error detection is possible with correction by application of viterbi algorithm.

3-160



6. For the Convolutional encoder with Constraint length of 3 and rate ½ as shown in figure, draw the state diagram and trellis diagram. Is the generated code systematic? By using this Viterbi algorithm, decode the sequence 0100010000....

3-162



7.Derive the Transfer function the convolutional code.

8.explain in detail about maximum likelihood decoding.

9.(i) what is meant by channel model?

(ii)write a short notes on

a)binary symmetric channel

b)Gaussian channel

10.let the code word of a coding scheme be

a=000000

b=101010

c=010101

d=111111

if the received sequence over a binary symmetric channel is 111010 and a maximum likelihood decoder is used,what will be the decoded symbol?

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

V SEMESTER

DIGITAL COMMUNICATION
(COMMON TO ECE & ETCE)

QUESTION BANK

UNIT-I

PART-A

1. State sampling theorem
2. Why flat-top sampling is better than natural sampling in PAM system?
3. What is meant by aliasing effect?
4. What is meant by Quantization?
5. What is Prediction filter?
6. What is the principle of TDM?
7. Draw the spectrum of sampled low pass signal.
8. Draw the spectrum of sampled band pass signal.
9. Define mid tread quantizer.
10. Define mid-riser quantizer.
11. Define quantization error.
12. What you mean by non-uniform quantization?
13. List out the disadvantage of uniform quantization over the non-uniform Quantization.
14. What is ISI?
15. State Nyquist criterion for zero ISI.
16. What is eye pattern?
17. What is adaptive equalization?
18. Define Nyquist interval?
19. Define Nyquist rate?
20. State sampling theorem for band pass signal.
21. State sampling theorem for stationary message process.
22. How to Format analog information?

23. List out types of coding format.

24. What are the types of Equalization?

25. What is channel characterization?

PART-B

1. State and explain Sampling theorem for low pass signals with spectral diagram.(12)
2. Draw and explain the structure of an adaptive equalization for data Transmission (12)
3. Explain the structure of Tapped delay line filters (12).
4. Describe the formation and application of eye pattern with relevant diagram for a Stream of bits.
5. a. Draw the spectral diagram for ideal Nyquist channel and explain minimum Bandwidth for zero ISI.

   b. explain eye pattern
6. Describe the different types of formats to represent the digital data and list out their merits and demerits with proper illustration.
7. Explain Uniform and non – uniform Quantization with neat diagram.
8. Explain the concept of Detection of binary signals in Gaussian noise.
9. Explain the concept of Matched filter receiver.
10. Explain the concept of maximum likelihood receiver.

UNIT-II
PART-A

1. What is the error probability of binary FSK system?
2. What are the different digital modulation techniques?
3. Compare binary PSK and QPSK.
4. Sketch the waveform of PSK for the binary sequence 1 1 0 1 0 0 1.
5. What are the advantages of M-ary signaling scheme?
6. What happens to the probability of M-ary FSK when the value of M-increases?
7. What is meant by correlative coding?
8. Differentiate coherent and non coherent methods.
9. What are antipodal signals?
10. Under what circumstances M-ary signaling schemes are preferred over binary schemes?
11. Compare bandwidth efficiency of M-ary PSK signals & M-ary FSK signals.
12. What is baseband signal receiver?
13. What is matched filter?
14. What is the impulse response of matched filter?
15. What is the value of maximum signal to noise ratio of the matched filter?
16. On what factor error probability of matched filter depends?
17. What is correlation?
18. Which digital modulation technique gives better error probability?
19. What are the advantages of QPSK?
20. What is synchronous detection?
21. What is envelope detection?
22. What is the bandwidth of BPSK signal?
23. What is the bandwidth of QPSK signal?
24. What is the bandwidth of M-ary FSK signal?
25. What is ON-OFF keying technique?

PART-B

1. a)With neat sketch explain the operation of BFSK modulation.

   b) Derive its probability of error equation.

2. a)Explain the block diagram for generation and reception of ASK along with its waveform.

   b) Derive the probability of error equation for ASK.

3. a)With neat sketch explain the operation of QPSK modulation.

   b) Derive its probability of error equation.

4. a)Explain the block diagram for generation and reception of BPSK along with its waveform.

   b) Derive the probability of error equation for BPSK.

5. Derive the probability of error equation for BPSK and BFSK.

6. Explain the performance of matched filter by obtaining error probability.

7. Write short notes on timing synchronization and carrier synchronization.

8. With neat sketch explain the operation of Non Coherent BFSK modulation.

   b) Derive its probability of error equation

9. a) With neat sketch explain the operation of Non Coherent BPSK modulation.

   b) Derive its probability of error equation.

10. Write short notes on

a. ASK

b. PSK

c. FSK

UNIT-III

PART-A

1. What are the three broad types of synchronization?
2. What is carrier synchronization?
3. What are the two methods for carrier synchronization?
4. What is called symbol or bit synchronization?
5. What are the two methods of bit and symbol synchronization?
6. What are the disadvantages of closed loop bit synchronization?
7. What is called frame synchronization?
8. Why synchronization is required?
9. Define phase lock
10. What is data aided synchronizer?
11. Draw the illustration of open loop bit synchronizer?
12. What is bandwidth occupancy?
13. Define symbol lock.
14. What is good synchronization codeword?
15. Write the linearized loop equation.
16. What is the expression for frequency error?
17. What is the expression for time error?
18. What are the probabilities that characterize the performance of a system?
19. Write the steady state tracking equation.
20. What is bandwidth occupancy?
21. What is the expression for frequency error?
22. What is the expression for time error?
23. What is frame marker?
24. What are the levels of synchronization required in non-coherent modulation?
25. What are the CPM signaling techniques?

PART-B

1. Explain how PLL is used in Receiver Synchronization with neat diagram
2. Explain about Frequency and phase synchronization with neat diagram.
3. Explain about Symbol Synchronization with neat diagram..
4. Explain about Synchronization with continuous phase modulation with neat diagram.
5. Explain about Frame Synchronization with neat diagram.
6. Explain about Network Synchronization with neat diagram.
7. Explain about
   a. Open loop transmitter Synchronization with neat diagram.
   b. Closed loop transmitter Synchronization with neat diagram.
8. Explain about
   a. Suppressed carrier loops
   b. Costas loop
9. Explain about Data –aided- Synchronization
10. Explain about Non Data –aided- Synchronization

UNIT IV

Part – A

1. Define pseudo-noise (PN) sequence.
2. What does the term catastrophic cyclic code represent?
3. Define a random binary sequence.
4. State the balance property of random binary sequence.
5. Mention about the run property.
6. Give the correlation property of random binary sequence.
7. Mention the significance of spread spectrum modulation.
8. What is called processing gain?
9. What is called jamming effect?
10. What is Anti jamming?
11. What are the three codes used for anti-jamming application?
12. What is meant by frequency-hop spread spectrum?
13. What is slow frequency hopping?
14. What is fast frequency hopping?
15. What are the two function of fast frequency hopping?
16. What are the features of code Division multiple Accesses?
17. What is called multi-path Interference?
18. Mention the advantages of a spread spectrum technique.
19. Compare direct sequence SS and frequency hopping SS.
20. Define acquisition.
21. Define tracking in SS.
22. List out the applications of spread spectrum system.
23. What is the principle of CDMA?
24 classify the types of spread spectrum.

25. Draw the circuit diagram to generate (PN) sequence for a length of seven.

PART – B

1. a) Draw and explain the block diagram of direct sequence spread spectrum transmitter and receiver system.(10)

   b) Mention its merits and demerits of direct sequence spread spectrum (2).

2. a) Draw and explain the block diagram of frequency hop spread spectrum transmitter and receiver system(9).

   b) The direct sequence spread spectrum system has following parameters .Data sequence Bit duration, Tb=4.095 ms,PN chip duration ,T_c= 1μs, E_b/N_o=10 for average Probability of error less than 10^{-5} .Calculate processing gain and jamming margin(3)

3.a) Discuss the ways in which fast hopping scheme and slow frequency hopping (Spread spectrum) schemes could be used to mitigate multipath effect(8)

   b) Explain the method of generation of pseudo noise sequence (4)

4. a) State and explain the properties of maximum length sequences(6)

   b) Explain with the block diagram of spread spectrum communication systems(6)

5. a) Explain the performance of direct sequence spread spectrum system (6).

   b) A PN sequence is generated using a feedback shift register of length 4(i.e. 4 stage). Find the generated output if the initial contents of the sequence shift register are 1000.If the chip rate is 10^7 chips/sec, calculate the chip and PN sequence duration and period of o/p sequence. Draw its schematic arrangement (6)

6.a)With neat sketch describe the principle of CDMA.(8)

   b) Mention the uses of CDMA.

7. Explain the operations of direct sequence SS using BPSK system.(12)

8. Explain the properties of maximum length sequence.(12)

9. Explain performance characteristics of DSSS system.(12)

10. a)Compare direct sequence SS and frequency hopped SS.(6)

    b) Explain various applications of spread spectrum.(6)

UNIT-V
PART-A

1. What is the difference between an unconditionally secure cipher and a computationally secure cipher?
2. Briefly define the Caesar cipher.
3. Briefly define the playfair cipher.
4. What is a transposition cipher?
5. What are the two basic functions used in encryption algorithms?
6. What is the difference between a block cipher and a stream cipher?
7. What are the two approaches to attacking a cipher?
8. What is the difference between diffusion and confusion?
9. What is the purpose of the S-boxes in DES?
10. What is the difference between a mono alphabetic cipher and a poly alphabetic cipher?
11. What are the essential ingredients of a symmetric cipher?
12. Define product cipher.
13. Briefly describe the Key Expansion Algorithm.
14. What is triple encryption?
15. List important design considerations for a stream cipher.
16. Differentiate public key encryption and conventional encryption.
17. Specify the application of public key cryptography.
18. What is message authentication?
19. Define the classes of message authentication function.
20. What you meant by MAC?
21. Specify the techniques for distribution of public key.
22. Specify the requirements for message authentication.
23. What are the services provided by PGP services?
24. Name any cryptographic keys used in PGP?
25. Define key Identifier?

PART-B

1. Explain in detail about the Classical Encryption Techniques.
2. Explain in detail about the DES Algorithm.
3. Explain in detail about the AES Algorithm.
4. Explain in detail about the RSA algorithm.
5. Describe Public Key Cryptography.
6. Explain about PGP services in detail.
7. Explain the concepts of Intrusion Detection.
8. Explain in detail about Authentication Functions.
9. Explain in detail about the functions of Hash Functions
10. Explain Digital Signature Standard.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

CONTROL SYSTEM

(Common to ECE, EEE, EIE, MECT, ETC)

V SEMESTER

QUESTION BANK

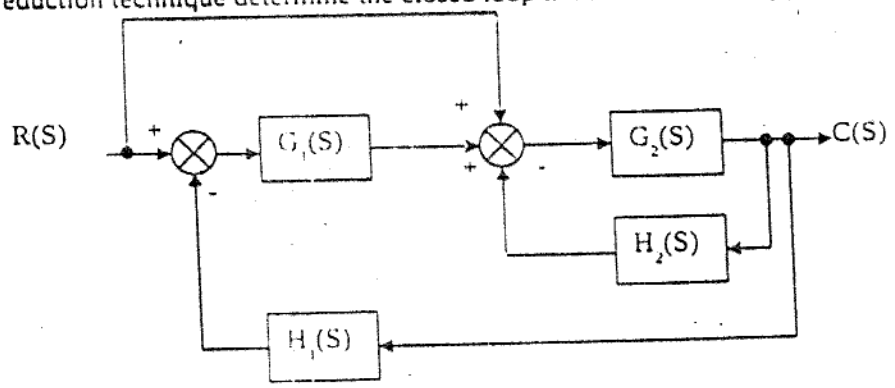
UNIT I

PART A

1. What is control system?
2. What are the two major types of control systems?
3. Explain open loop control system.
4. Define closed loop control system.
5. What are the components of feedback control system?
6. Distinguish between open loop and closed loop control system.
7. Define transfer function.
8. What are the basic elements used for modeling translational system?
9. Write the force balance equation of ideal mass, dash pot and spring.
10. What is block diagram?
11. What are the basic components of block diagram?
12. What is a signal flow graph?
13. Define non touching loop.
14. What are the basic properties of signal flow graph?
15. Write Mason gain formula and write the steps involve in signal flow graph
16. What are the types of systems?
17. Define feedback?
18. What are the types of mechanical systems?
19. Write the steps for block diagram reduction
20. Write the rule for eliminating negative feedback loop.

PART B

1) The block diagram of a closed loop system is shown in the figure using the Block reduction technique determine the closed loop transfer function C(s)/R(s).



UNIT-IV

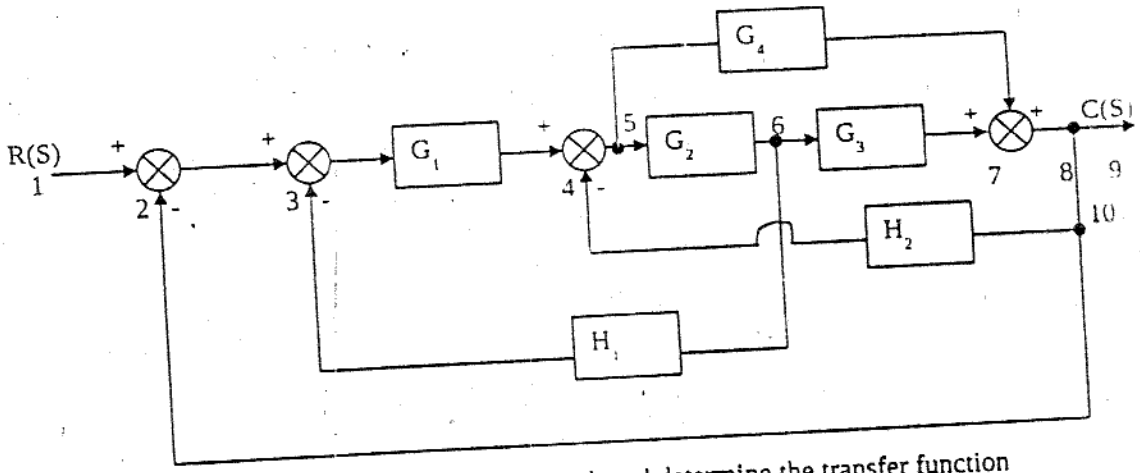
PART-A

1. What is meant by laser welding?
2. What is meant by laser trimming?
3. What are the industrial applications of laser?
4. What are the two modes of laser melting process?
5. What are types of laser welding?
6. What are the types of laser trimming?
7. List out the advantages of laser welding.
8. What is meant by industrial application of laser?
9. What are types of lasers are used for material removal and vapourisation.
10. What are the disadvantages of measurement of distance for laser?
11. What is the principal of measurement of velocity for laser?
12. List out the advantages of measurement of velocity for laser.
13. List out the disadvantages of measurement of velocity for laser.
14. What are the classifications of laser welding?
15. List out the advantages of laser trimming.
16. What is meant by industrial application of laser?
17. List out the modes of laser melting process.
18. Draw the diagram of material processing.
19. List out the advantages of measurement of velocity for laser.
20. What is meant by LIDAR?
21. List out the applications of LIDAR.
22. What are the classifications of LIDAR?
23. List out the disadvantages of measurement of velocity for laser.
24. List out the types of lasers is used for material removal and vaporization.
25. List out the goals of plastic surgery.

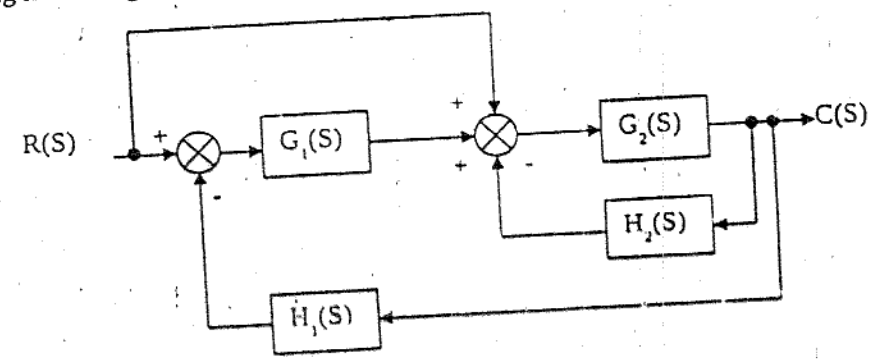
PART-B

1. Explain the principle of laser for the measurement of distance and velocity with neat diagram.
2. Explain the working principle of laser for the measurement of current and voltage with neat diagram.
3. Describe the principles of laser welding and melting.
4. Explain the principle of laser for the measurement of atmospheric effect with neat diagram.
5. Discuss the application of laser material processing.
6. Explain the application of laser in removal and vaporization of materials.
7. Describe the principle of LIDAR and the applications.
8. Describe in detail the principle of measurement of length, and acceleration.
9. Write short notes on irradiance and interaction time.
10. Describe the principles of cold atom gradiometer.

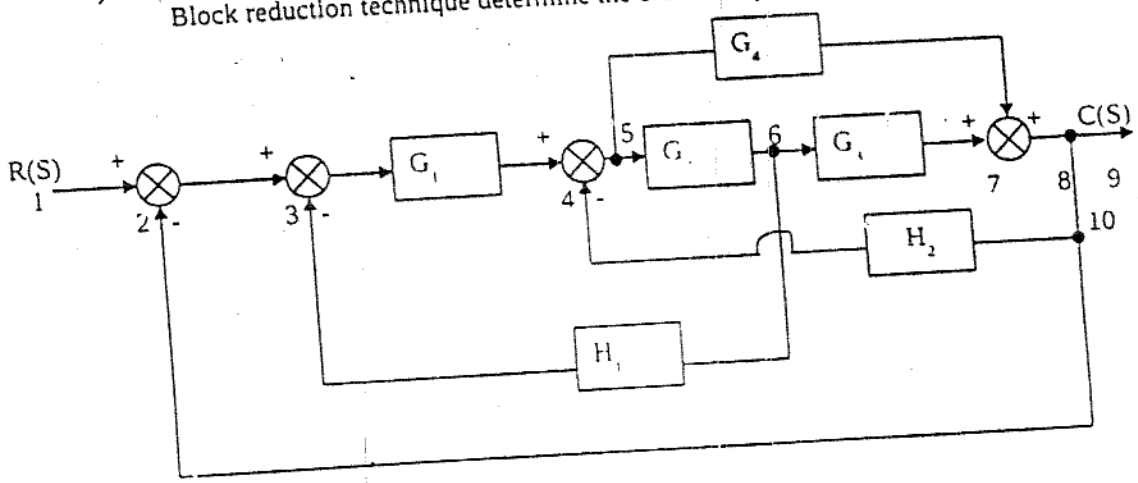
2) Convert the block diagram to signal flow graph and determine the transfer function using mason's gain formula.



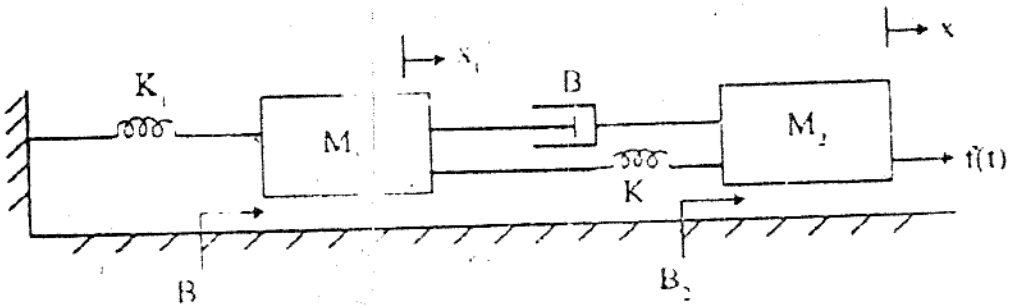
3) Convert the block diagram to signal flow graph and determine the transfer function using mason's gain formula.



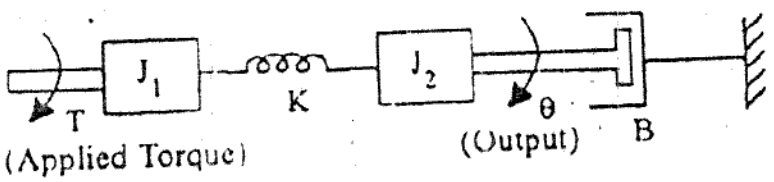
4) The block diagram of a closed loop system is shown in the figure using the Block reduction technique determine the closed loop transfer function C(s)/R(s).



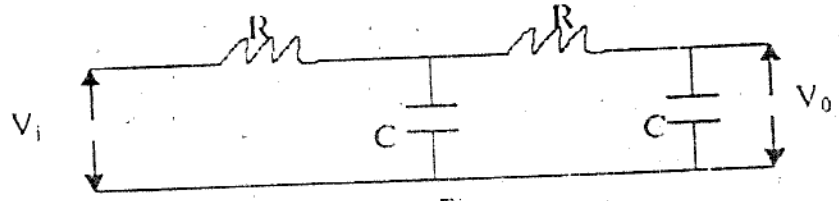
5) Write the differential equations governing the mechanical system shown in figure and determine the transfer function.



6. Write the differential equations governing the mechanical rotational system shown in figure. Obtain the transfer function of the system.



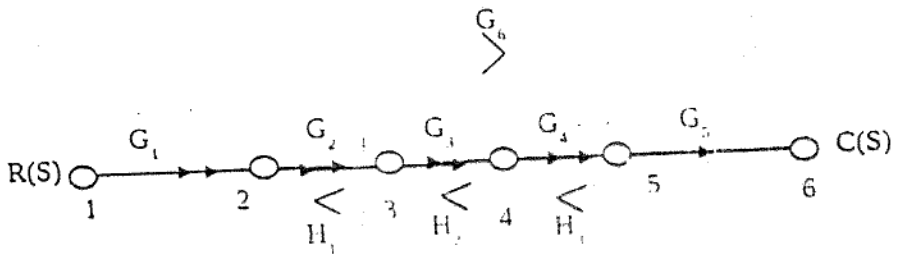
7. Derive the transfer function of the network shown in fig.



8. Derive the transfer function of armature controlled DC motor.

9. Derive the transfer function of field controlled DC motor.

10. The signal flow graph for a feedback control system is shown in fig. Determine the closed loop transfer function C(s) /R(s)



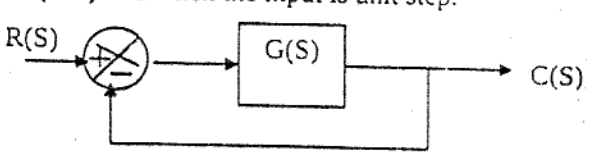
UNIT – II

PART – A

1. What is the order of a system?
2. How the system is classified depending on the value of damping?
3. The closed loop transfer function of second order system is $\frac{C(s)}{R(s)} = \frac{10}{s^2 + 6s + 10}$
   Find the error constant.
4. What is the type of damping in the system?
5. What is steady state error?
6. What are the generalized error coefficients?
7. Mention two advantages of generalized error constants over static error constants.
8. Define settling time.
9. Define parabolic signal.
10. Write the formula for finding the velocity error constant?
11. Why derivative controller is not used in control system?
12. What is a time response?
13. Name the test signals used in a control system.
14. Define step signal.
15. Define ramp signal.
16. What is an impulse signal?
17. Define damping ratio.
18. What is damping frequency of oscillation?
19. List the time domain specifications.
20. Sketch the response of a second order under damped system.
21. What is steady state error?
22. Mention two advantages of generalized error constants over static error constants.
23. What is the advantage in proportional controller?
24. What is the effect of PI controller on the system performance?
25. Why derivative controller is used in control systems?

PART – B

1. Obtain the response of unity feedback system whose open loop transfer function is G(S) = 4/s(s+4) and when the input is unit step.



2. Derive the expression for unit impulse response of a second order under damped system

$$G(s)=\frac{\omega_n^2}{s^2+2\xi\omega_n s+\omega_n^2}$$

3. Find the unit impulse response of the second order system whose transfer function.

$$G(s)=\frac{9}{S^2+4S+9}$$

4. Measurements conducted on a servomechanism show the system response to be $C(t) = 1+ 0.2\ e^{-60t} -1.2e^{-10t}$ when subject to a unit step input. Obtain an expression for closed loop transfer function. Determine the undamped natural frequency and damping ratio.

5. A unity feedback control system is characterized by the following open loop transfer function $G(s) = (0.4s + 1) / s\ (s + 0.6)$. Determine its transient response for unit step input and sketch the response. Evaluate the maximum overshoot and the corresponding peak time.

6. Derive the expression for steady state error of the closed loop system in terms of generalized error coefficients.

7. Derive the expression for peak time from the expression for step response of second order under damped system.

8. A unity feedback control system has an open loop transfer function, $G(s) = 10/ s(s+2)$. Find the rise time, percentage overshoot, peak time and settling time for a step input of 12 units.

9. Derive the expression for evaluation of generalized error coefficients.

10. Derive the expression for the response with P, PI and PID controllers.

UNIT III

PART A

1. What is frequency response?
2. What are the advantages of frequency response analysis?
3. What are the frequency domain specifications?
4. Define resonant peak.
5. What is resonance frequency?
6. Define bandwidth.
7. Explain gain margin
8. Define phase margin
9. What is the expression for resonant peak and resonant frequency?
10. What is a Nicholas plot
11. What are the advantage of polar plot
12. Define polar plot
13. Define bode plot
14. What are M and N circles?
15. What is cut off rate
16. What is gain cross over frequency
17. What is phase cross over frequency
18. Define corner frequency.
19. What is root locus?
20. What is magnitude criterion?

PART B

1. The open loop transfer function of a unity feedback system is given by $G(S)=1/S(1+S)(1+2S)$.Sketch the polar plot and determine the gain margin and phase margin.
2. Consider a unity feed back system having open loop transfer function $G(S) = 1/S^2(1+S)(1+2S)$. sketch pola plot find gain and phase margin
3. Derive M circle
4. Derive N circle
5. Write the procedure for Nichols chart
6. Consider a unity feed back system having open loop transfer function $G(S) = 75(1+0.2s)/s(s+5)$. sketch bode plot
7. Write the procedure for polar plot
8. For the following transfer function draw bode plot $G(S) = 20/S(1+3s)(1+4s)$
9. Write the procedure for bode plot
10. Plot the Bode diagram for the following transfer function and obtain the gain and phase over frequencies. $G(S) =10/S(1+0.04S)(1+0.1S)$.

UNIT IV

PART A

1) Define BIBO stability.
2) What is impulse response?
3) What is the requirement for BIBO stability?
4) How the roots of characteristics equation are related stability?
5) What is the necessary condition for stability?
6) What is routh stability criterion?
7) What is Nyquist stability criterion?
8) What is root locus?
9) Write the transfer function of Nyquist stability criterion?
10) What is magnitude criterion?
11) What is angle criterion?
12) What is centroid? How the centroid is calculated?
13) What is dominant pole?
14) For the system represented by the following characteristic equation say whether the necessary condition for stability is satisfied or not. (i)$S^4+3S^3+4S^2+5S+10=0$. (ii) $S^3-8S^2+7S+6=0$.
15) Distinguish between the concept of encircled and enclosed of Nyquist stability criterion?
16) Define gain margin and phase margin.

PART B

1) What are the necessary conditions for stability?
2) Using Routh criterion, determine the stability of the system represented by the characteristics equation, $s^4+8s^3+18s^2+16s+5 = 0$. Comment on the location of the roots of the roots of characteristics equation.
3) Construct Routh array and determine the stability of the system represented by the Characteristic equation $s^5+s^4+2s^3+2s^2+3s+5 = 0$. Comment on the location of the roots of characteristics equation.

4) Construct Routh array and determine the stability of the system whose characteristics equation, $s^6+2s^5+8s^4+12s^3+20s^2+16s+16 = 0$. Also determine the number of roots lying on the half of s-plane and on imaginary axis.

5) The open loop transfer function of a unity feedback system is given by
$G(s) = K/(s+2)(s+4)(s^2+6s+25)$.

6) Write the procedure for investigating the stability using Nyquist criterion.

7) Draw the Nyquist plot for the system whose open loop transfer function is $G(s)H(s) = K/s(s+2)(s+10)$. Determine the range of K for which closed loop system is stable.

8) Construct the Nyquist plot for a system whose open loop transfer function is given by $G(s)H(s)= K(1+s)^2/s^3$.Find the range of K for stability.

9) The open loop transfer function of a unity feedback system is given by $G(s) = K/s(1+sT_1)(1+sT_2)$.Determine an expression for gain K in terms T_1, T_2 and specified gain margin, K_g.

10) Determine the Gain crossover frequency, phase crossover frequency, Gain margin an phase margin of a system with open loop transfer function, $G(s)=1/s(1+2s)(1+s)$.

UNIT V

PART A

1. What is meant by Compensation?
2. Write the necessary frequency domain specifications for design of a control system.
3. List out the different types of compensator
4. Sketch an Electric lag-lead network of a lag-lead compensator.
5. Sketch an Electric lead network of a lead compensator.
6. Draw the bode plot of a lead compensator.

7. What is meant by lag compensator?
8. Write the transfer function of a typical lead-lag compensator.
9. What is meant by lag-lead compensator?
10. Sketch an electric lag network of a lag compensator.
11. Draw the bode plot of a lag compensator.
12. Why compensation is necessary in feedback control system?
13. Write the transfer function of a typical lead compensator.
14. Write the transfer function of a typical lag compensator.
15. Draw the bode plot of lag-lead compensator.
16. What are the characteristics of lead compensation?
17. List out the characteristics of lag-lead compensation?
18. List out the advantages in frequency domain design.
19. When maximum phase lag occurs in lag compensator?
20. Write down the expressions for maximum lag angle and the corresponding frequency.
21. Draw the pole zero plot for the lag compensator.
22. What is meant by series compensation?
23. List out the factors to be considered for choosing series compensation.
24. Draw the pole zero plot for the lead compensator.
25. Draw the pole zero plot for the lag-lead compensator.

PART B

1 Write the frequency response of lag compensator.

2 The controlled plant of a unity feedback system is $G(s) = K/s(s+5)$. It is specified that velocity error constant of the system be equal to 15, while the damping ratio is 0.6 and velocity error is less than 0.25 rad per unit ramp input. Design a suitable lag compensator?

2nd A1

3 A unity feedback system has an open loop transfer function, $G(s) = K/s(1+2s)$. Design a suitable lag compensator so that phase margin is 40° and the steady state error for ramp input is less than or equal to 0.2.

4 Write the frequency response of lead compensator.

5 The open loop transfer function of certain unity feedback control system is given by $G(s) = K/s\ (0.1s+1)\ (0.2s+1)$. It is designed to have the phase margin to be at least 30°. Design a suitable lead series compensator.

6 Write the procedure of lag-lead compensator on root locus and frequency domain method.

7 Write the realization of lag-lead compensator using electrical network.

8. Describe the different types of compensation schemes.

9. Explain the design procedure of a lag compensator.

10. Explain the design procedure of a lag-lead compensator.