TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEI	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - RF and Microwave Engineering (EX 716)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks.**
✓ **Necessary Formulas and Smith Charts are attached herewith.**
✓ Assume suitable data if necessary.

1. Compare the behavior of circuits for Low frequency/ Conventional and RF/ Microwave bands. Classify microwave frequency band and its application in major areas. [3+3]

2. A 50 Ω lossless transmission line is required to be matched with the load admittance 0.00813 + j0.0065 ℧, by a double-stub shunt tuner with separation of 3λ/8 and the distance of the first stub from the load is 0.01λ. Calculate the length of each stub by using the smith chart. Write the s-parameter for the matched network. [8+2]

3. Why S-parameters are used in high frequencies? The S-matrix of certain microwave network is given as

$$S = \begin{bmatrix} 0.4 + j0.5 & j0.6 \\ j0.6 & 0.4 - j0.5 \end{bmatrix}$$ [3+1+1+1+2]

   a) Is the network reciprocal?
   b) Is the network lossless?
   c) What is the return loss at the input?
   d) If the input power to the network is 5 watts. What is the reflected power?

4. Provide the fundamental field and characteristic equations of a circular waveguide for TE mode. [10]

5. How is the output of conventional tubes reduced at microwaves due to inter-electrode capacitance, lead inductance and transit time effect? Explain about the construction and working principle of TWT. [2+6]

6. For transistor having following S-parameter S_{11} = 0.894 ∠ -60.6°, S_{21}= 3.122 ∠ 123.6°, S_{12} = 0.020 ∠ 62.4°, S_{22} = 0.781 ∠ -27.6°. Determine the stability and compare maximum power gains for bilateral and unilateral modes. [5+5]

7. How is a low pass filter prototype based on Butterworth approximation designed using insertion loss method? Implement a low pass filter π section using microstrips. [6+2]

8. Explain the RF/MW radiation hazards and its safety practices. [3+3]

9. List out the major RF/MW measurement parameters. How the VSWR of any microwave transmitter (In case of VSWR > 10) can be measured? Explain. [2+6]

10. Write short notes on: [2×3]

    a) Microwave Magic Tee
    b) Gunn-diode

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Supplied Formulas:

$$\Delta = S_{11}S_{22} - S_{12}S_{21}$$

$$K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2|S_{12}S_{21}|}$$

$$\mu = \frac{1 - |S_{11}|^2}{|S_{22} - \Delta S_{11}^*| + |S_{12}S_{21}|}$$

$$\Gamma_s = \frac{B_1 \pm \sqrt{B_1^2 - 4|C_1|^2}}{2C_1}$$

$$\Gamma_L = \frac{B_2 \pm \sqrt{B_2^2 - 4|C_2|^2}}{2C_2}$$

$$B_1 = 1 + |S_{11}|^2 - |S_{22}|^2 - |\Delta|^2$$

$$B_2 = 1 + |S_{22}|^2 - |S_{11}|^2 - |\Delta|^2$$

$$C_1 = S_{11} - \Delta S_{22}^*$$

$$C_2 = S_{22} - \Delta S_{11}^*$$

$$C_S = \frac{(S_{11} - \Delta S_{22}^*)^*}{|S_{11}|^2 - |\Delta|^2}$$

$$C_L = \frac{(S_{22} - \Delta S_{11}^*)^*}{|S_{22}|^2 - |\Delta|^2}$$

$$R_S = \frac{|S_{12}S_{21}|}{|S_{11}|^2 - |\Delta|^2}$$

$$R_L = \frac{|S_{12}S_{21}|}{|S_{22}|^2 - |\Delta|^2}$$

$$G_{T\ Max} = \frac{1}{1 - |\Gamma_s|^2} \cdot |S_{21}|^2 \cdot \frac{1 - |\Gamma_L|^2}{|1 - S_{22}\Gamma_L|^2}$$

$$G_{TU\ Max} = \frac{1}{1 - |S_{11}|^2} \cdot |S_{21}|^2 \cdot \frac{1}{1 - |S_{22}|^2}$$

Subject: - RF and Microwave Engineering *(EX 752)*

✓. Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ The figures in the margin indicate *Full Marks.*
✓ *Necessary formulas are attached herewith.*
✓ Assume suitable data if necessary.

1. Explain the behavior of microwave circuits. Also discuss the advantages and disadvantages of using microwave frequency. [4+4]

2. Sketch a double-stub perfectly matched network using microstrip and prepare its s-matrix. [2+8]

3. For a rectangular waveguide, with suitably assumed breadth, width and frequency, (for dominant mode), determine cut-off frequency, phase velocity, propagation wavelength in the waveguide and the characteristic impedance. [6]

4. Explain the properties of two Magic Tees if one connects their E-arms and derive its S-matrix. [10]

5. Derive explicitly the field equations of Rectangular waveguides for TE modes. [8]

6. What is transit time effect? State the working principles of a magtron having phase difference of 45° of adjacent cavities. [2+6]

7. A microwave amplifier operates in Ku-Band for satellite transmit system uses a High Electron Mobility GaAs MOSFET transistor having following S-parameters at 4 GHz with 50 Ω line impedance as, $S_{11} = 0.72 \angle -116°$, $S_{12} = 0.03 \angle 57°$ $S_{21} = 2.60 \angle 76°$ and $S_{22} = 0.73 \angle -54°$. Check the stability of the given transistor and compare maximum power gain for bilateral and unilateral mode. [5+5]

8. Describe in detail the procedures for prototyping Butterworth LPF using insertion loss method. [8]

9. How are microwaves hazardous to humans? Define different radiation zones of a microwave oven. [3+3]

10. Explain how microwave power is measured with static calori meter. [6]

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$$\Delta = S_{11}S_{22} - S_{12}S_{21}$$

$$K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2|S_{12}S_{21}|}$$

$$\mu = \frac{1 - |S_{11}|^2}{|S_{22} - \Delta S_{11}^*| + |S_{12}S_{21}|}$$

$$\Gamma_s = \frac{B_1 \pm \sqrt{B_1^2 - 4|C_1|^2}}{2C_1}$$

$$\Gamma_L = \frac{B_2 \pm \sqrt{B_2^2 - 4|C_2|^2}}{2C_2}$$

$$B_1 = 1 + |S_{11}|^2 - |S_{22}|^2 - |\Delta|^2$$

$$B_2 = 1 + |S_{22}|^2 - |S_{11}|^2 - |\Delta|^2$$

$$C_1 = S_{11} - \Delta S_{22}^*$$

$$C_2 = S_{22} - \Delta S_{11}^*$$

$$C_s = \frac{(S_{11} - \Delta S_{22}^*)^*}{|S_{11}|^2 - |\Delta|^2}$$

$$C_L = \frac{(S_{22} - \Delta S_{11}^*)^*}{|S_{22}|^2 - |\Delta|^2}$$

$$R_s = \frac{|S_{12}S_{21}|}{|S_{11}|^2 - |\Delta|^2}$$

$$R_L = \frac{|S_{12}S_{21}|}{|S_{22}|^2 - |\Delta|^2}$$

$$G_{T\,Max} = \frac{1}{1 - |\Gamma_s|^2} \cdot |S_{21}|^2 \cdot \frac{1 - |\Gamma_L|^2}{|1 - S_{22}\Gamma_L|^2}$$

$$G_{TU\,Max} = \frac{1}{1 - |S_{11}|^2} \cdot |S_{21}|^2 \cdot \frac{1}{1 - |S_{22}|^2}$$

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Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - RF and Microwave Engineering *(EX 752)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ *Attempt __All__ questions.*
✓ *The figures in the margin indicate __Full Marks__.*
✓ __*Necessary formulas and Smith Charts are attached herewith.*__
✓ *Assume suitable data if necessary.*

1. How is microwave frequency band classified by the IEEE? Enumerate the basic advantages and disadvantages of microwaves compared to lower frequencies. [5+5]

2. A single-stub tuner is to match a lossless line to a load of an antenna. Design the stub with any assumed placement and length and derive its S-matrix. [10]

3. A radar installation engineer is given a responsibility to install an Airport Surveillance Radar that requires half input power to the antenna than the transmitter that can deliver using a duplexer. Prepare its S-matrix. [10]

4. Explain field and characteristics equations of a rectangular wave guide working in TM mode. [10]

5. A microwave transistor has the following scattering parameters at 1.0GHz, with a 50Ω line impedance:
   $S_{11}=0.38<-158°$
   $S_{12}=0.11<54°$
   $S_{21}=3.50<80°$
   $S_{22}=0.40<-43°$
   The source impedance is $Z_s=25Ω$ and load impedance is $Z_L=40Ω$. Compute the gains of input and output matching networks. Also, draw a design a flowchart. [6+4]

6. How is a low pass filter prototype based on Butterworth and Chebyshev approximations designed using insertion loss method? Implement a low pass filter double π-sections using microstips. [8+2]

7. Name and explain different microwave radiation fields. Describe different international EMR safety standards and practices. [5+5]

8. Explain power measurement using static and dry calorimeters. [10]

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$$K = \frac{1-|S_{11}|^2 - |S_{22}|^2 + |\Delta|^2}{2|S_{12}S_{21}|}$$

$$GT_{max} = \frac{1}{1-|\Gamma_S|^2}|S_{21}|^2 \frac{1-|\Gamma_L|^2}{|1-S_{22}\Gamma_L|^2}$$

$$\mu = \frac{1-|S_{11}|^2}{|S_{22} - \Delta S_{11}^*| + |S_{12}S_{21}|}$$

$$\Gamma_s = \frac{B_1 \pm \sqrt{B_1^2 - 4|C_1|^2}}{2C_1}$$

$$C_L = \frac{(S_{22} - \Delta S_{11}^*)^*}{|S_{22}|^2 - |\Delta|^2}$$

$$B_1 = 1 + |S_{11}|^2 - |S_{22}|^2 - |\Delta|^2$$

$$R_L = \frac{|S_{12}S_{21}|}{|S_{22}|^2 - |\Delta|^2}$$

$$C_1 = S_{11} - \Delta S_{22}^*$$

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - RF and Microwave Engineering *(EX752)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ *Necessary formulas and smith charts are provided herewith.*
✓ Assume suitable data if necessary.

1. How the circuit at seismic band is different from its RF/Microwave counterparts? Explain. [8]

2. A 75-ohm, coaxial line is terminated with a normalized complex load of 0.4 + j0.85 ohms. Design a double-stub matching system using short-circuited coaxial line of 75-ohm characteristic impedance. Sketch the network using micro strip. [10+2]

3. a) Analyze a three-port directional coupler using S-parameters. [4]

   b) Which of the passive microwave device is explained by this S-matrix. Judge the condition and explain its characteristics.

$$[S] = \begin{bmatrix} S_{11} & 0 & S_{13} & S_{14} \\ 0 & S_{22} & -S_{13} & S_{14} \\ S_{13} & -S_{13} & 0 & 0 \\ S_{14} & S_{14} & 0 & 0 \end{bmatrix}$$

   [6]

4. Derive the expression for the field strength for TM waves for a air-filled circular waveguide. Check the dominant mode in TE and TM modes. [8+2]

5. With neat circuit diagrams and relevant equations, explain the velocity modulation process and bunching in a multicavity reflex klystron. [10]

6. a) Refer the sketched smith chart (Fig.Q6) and analyze/synthesize the stabilities. Assume necessary parameters as desired. Mention all the steps. [5]

   b) Describe the insertion loss method used for the filter designing. [5]

7. a) Discuss in detail the power measurement using circulating calorimeter. [5]

   b) How microwave radiation becomes hazardous to human body? [5]

8. What do you understand by immitance chart? Sketch it. List out all duality parameters vital to designing microwave networks. [10]

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$$|\Delta| = |S_{11}S_{22} - S_{12}S_{21}|$$

$$K = \frac{1 - |S_{11}|^2 - |S_{22}|^2 + |\Delta|^2}{2|S_{12}S_{21}|}$$

$$\mu = \frac{1 - |S_{11}|^2}{|S_{22} - \Delta S_{11}^*| + |S_{12}S_{21}|}$$

$$C_L = \frac{(S_{22} - \Delta S_{11}^*)^*}{|S_{22}|^2 - |\Delta|^2}$$

$$R_L = \frac{|S_{12}S_{21}|}{|S_{22}|^2 - |\Delta|^2}$$

$$\Gamma_S = \frac{B_1 \pm \sqrt{B_1^2 - 4|C_1|^2}}{2C_1}.$$

$$B_1 = 1 + |S_{11}|^2 - |S_{22}|^2 - |\Delta|^2.$$

$$GTU_{max} = \frac{1}{1 - |S_{11}|^2} |S_{21}|^2 \frac{1}{1 - |S_{22}|^2}.$$

Exam.		Back	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - RF and Microwave Engineering (EX752)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
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1. Explain the behavior of microwave circuits. Also discuss the applications of microwave in space technology. [5+3]

2. A microwave generator operates at 2 GHz, is terminated by parabolic antenna having impedance of 60 - j80 Ω through a medium of 50Ω. Design the length of the short circuited double stubs for open design when the match is achieved. Also illustrate the necessary physical connection of your design. [10+2]

3. a) Why S-parameter is important in microwave network analysis?

   b) Sketch an immitance chart, and list out at least ten duality parameters critically used in microwaves. [5+5]

4. a) Find out the device having following s-parameters, and discuss its characteristics.

$$[s] = \begin{bmatrix} S_{11} & 0 & S_{13} & S_{14} \\ 0 & S_{22} & -S_{13} & S_{14} \\ S_{13} & -S_{13} & S_{33} & 0 \\ S_{14} & S_{14} & 0 & S_{44} \end{bmatrix}$$

   b) Change this s-matrix for real lossless condition and explain. [6+4]

5. What is transit time effect? State the working principles of any cavity oscillating device using the transit time and bunching effects. [2+6]

6. a) Refer the provided smith chart (Fig. Q6), and synthesize the stability of an amplifier using arbitrarily defined parameters.

   b) Draw a flow chart to design a solid-state microwave amplifier for maximum gain. [10+4]

7. How is a low pass filter prototyped by insertion loss method using Butterworth approximation? How are the elemental values of the filter calculated? Sketch a double sectioned series armed high pass filter using micro strip. [6+3]

8. How a VNA used in microwave networks? Explain power measurement using static calorimeter. [4+5]

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Supplied Formulas:

$$K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2|S_{12}||S_{21}|}$$

$$\Delta = (S_{11}S_{22} - S_{12}S_{21})$$

$$\mu = \frac{1 - |S_{11}|^2}{|S_{22} - \Delta S^*_{11}| + |S_{21}S_{12}|}$$

$$\Gamma_L = \frac{B_2 \pm \sqrt{B_2^2 - 4|C_2|^2}}{2C_2}$$

$$B_2 = 1 + |S_{22}|^2 - |S_{11}|^2 - |\Delta|^2$$

$$C_2 = S_{22} - \Delta S^*_{11}$$

$$C_L = \frac{(S_{22} - \Delta S^*_{11})}{|S_{22}|^2 - |\Delta|^2}$$

$$R_L = \frac{|S_{12}S_{21}|}{|S_{22}|^2 - |\Delta|^2}$$

$$G_{Tmax} = \left(\frac{1}{1 - |\Gamma_S|^2}\right)|S_{21}|^2\left(\frac{1 - |\Gamma_L|^2}{|1 - S_{22}\Gamma_L|^2}\right)$$

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - RF and Microwave Engineering (EX752)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt _All_ questions.
✓ The figures in the margin indicate _Full Marks_.
✓ _Necessary figures and Chart are attached herewith._
✓ Assume suitable data if necessary.

1. Design a single short and open-circuited shunt matching network for a transmission line using Smith Chart by considering an output reflection coefficient $\Gamma_L = 0.5\angle51°$ Ohm and surge impedance $Z_0 = 50$ Ohm. [8]

2. Indentify and explain the properties of a microwave passive device having following S-Matrix. [8]

$$\begin{bmatrix} S_{11} & S_{12} & S_{13} & S_{14} \\ S_{21} & S_{22} & {}_{13} & -S_{14} \\ S_{13} & S_{13} & 0 & 0 \\ S_{14} & -S_{14} & 0 & 0 \end{bmatrix}$$

3. Sketch a flowchart for designing a microwave amplifier using a GaAsFET. Consider the following S-parameters and find maximum gain for both bilateral and unilateral model. Also using the calculated value of Γ_{in} and Γ_{out} trace Z_{in} and Z_{out} in the smith chart. [4+4+4+4]

$$[S] = \begin{bmatrix} 0.656\angle146.7° & 0.122\angle46.1° \\ 2.30\angle44.7° & 0.172\angle-117.1° \end{bmatrix}$$

4. Synthesize stability parameters of input matching network for the attached sketched smith chart. [8]

5. Choose a proper microwave measurement tool to test an antenna as a DUT; and explain its working principles. [8]

6. Explain in detail the designing steps of microwave filters. Illustrate an example of passive HPF using microstrips. [6+4]

7. Express field equations of a rectangular waveguide for TM mode. [10]

8. Write short notes on: (any two) [6×2]

   i) Effect of SAR as microwave radiation hazards
   ii) Features of microwave frequency band
   iii) Backward Wave Oscillator
   iv) Microwave Cavity Resonators

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$$K = \frac{1+|\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2|S_{12}||S_{21}|},$$

$$\Delta = (S_{11}S_{22}) - (S_{12}S_{21}),$$

$$\mu = \frac{1-|S_{11}|^2}{|S_{22} - \Delta S_{11}^*| + |S_{21}S_{12}|}$$

$$\Gamma_s = \frac{B_1 \pm \sqrt{B_1^2 - 4|C_1|^2}}{2C_1},$$

$$\Gamma_L = \frac{B_2 \pm \sqrt{B_2^2 - 4|C_2|^2}}{2C_2}, \text{ where}$$

$$B_1 = 1 + |S_{11}|^2 - |S_{22}|^2 - |\Delta|^2,$$

$$B_2 = 1 + |S_{22}|^2 - |S_{11}|^2 - |\Delta|^2,$$

$$C_1 = S_{11} - \Delta S_{22}^*, \text{ and}$$

$$C_2 = S_{22} - \Delta S_{11}^*$$

$$C_L = \frac{(S_{22} - \Delta S_{11}^*)^*}{|S_{22}|^2 - |\Delta|^2}$$

$$C_S = \frac{(S_{11} - \Delta S_{22}^*)^*}{|S_{11}|^2 - |\Delta|^2}$$

$$R_L = \frac{|S_{12}S_{21}|}{|S_{22}|^2 - |\Delta|^2}$$

$$R_S = \frac{|S_{12}S_{21}|}{|S_{11}|^2 - |\Delta|^2}$$

$$G_{Tmax} = \left(\frac{1}{|1-S_{11}\Gamma_S|^2}\right)|S_{21}|^2 \left(\frac{1-|\Gamma_L|^2}{|1-S_{22}\Gamma_L|^2}\right)$$

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Exam.			
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - RF and Microwave Engineering (EX752)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
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✓ *Assume suitable data if necessary.*

1. What are the advantages of using double stub matching over single stub matching? Explain the necessary steps for impedance matching of a load to a transmission line using double-stub matching network with an appropriate example. Use provided Smith Chart. [2+8]

2. Why are S-parameters used in microwave network analysis? Analyze three port network using S-parameters. [2+6]

3. Suppose there are two identical radar transmitters in equipment stock. A particular application required twice more input power to an antenna than either transmitter can deliver. Give your appropriate solution for the given problem with explanation using S-matrix. [6]

4. Describe the working principle and applications of cavity magnetron having phase shift of 45° between the cavities. [8]

5. Given S-parameters for microwave transistor amplifier: [12]

$S_{11} = 0.78 \angle-113°$ $S_{12} = 0.028 \angle247°$

$S_{21} = 2.60 \angle76°$ $S_{22} = 0.81 \angle-54°$

Determine the stability and compare maximum power gain for unilateral and bilateral modes using supplied formulas.

6. How is low pass filter implemented using microstrip? How are the low pass filter prototyped? [5+3]

7. What are the different types of electromagnetic radiation hazard? Illustrate radiation fields of a microwave oven. [4+4]

8. Choose a proper power measurement tool to measure power of a Airport Serveillence Radar. [8]

9. Write short notes on: [4×3]

   i) Behavior of microwave bands
   ii) Field equation of rectangular wave guide for TE mode
   iii) Cavity Resonators

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$$\Delta = S_{11}S_{22} - S_{12}S_{21}$$

$$K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2|S_{12}S_{21}|}$$

$$\mu = \frac{1 - |S_{11}|^2}{|S_{22} - \Delta S_{11}^*| + |S_{12}S_{21}|}$$

$$\Gamma_s = \frac{B_1 \pm \sqrt{B_1^2 - 4|C_1|^2}}{2C_1}$$

$$\Gamma_i = \frac{B_2 \pm \sqrt{B_2^2 - 4|C_2|^2}}{2C_2}$$

$$B_1 = 1 + |S_{11}|^2 - |S_{22}|^2 - |\Delta|^2$$

$$B_2 = 1 + |S_{22}|^2 - |S_{11}|^2 - |\Delta|^2$$

$$C_1 = S_{11} - \Delta S_{22}^*$$

$$C_2 = S_{22} - \Delta S_{11}^*$$

$$C_s = \frac{(S_{11} - \Delta S_{22}^*)^*}{|S_{11}|^2 - |\Delta|^2}$$

$$C_i = \frac{(S_{22} - \Delta S_{11}^*)^*}{|S_{22}|^2 - |\Delta|^2}$$

$$R_s \quad \frac{|S_{12}S_{21}|}{|S_{11}|^2 - |\Delta|^2}$$

$$R_i = \frac{|S_{12}S_{21}|}{|S_{22}|^2 - |\Delta|^2}$$

$$G_{T,Max} = \frac{1}{1 - |\Gamma_s|^2} |S_{21}|^2 \frac{1 - |\Gamma_i|^2}{|1 - S_{22}\Gamma_i|^2}$$

$$G_{TU,Max} = \frac{1}{1 - |S_{11}|^2} |S_{21}|^2 \frac{1}{1 - |S_{22}|^2}$$

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Exam.		Regular	
Level	BE	**Full Marks**	80
Programme	BEX	**Pass Marks**	32
Year / Part	IV / II	**Time**	3 hrs.

Subject: - RF and Microwave Engineering *(EX752)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ *Attempt __All__ questions.*
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✓ *__Necessary formula, graph and figures are attached herewith.__*
✓ *Assume suitable data if necessary.*

1. Classify signal frequency in different bands of waves and rays. What are the advantages and disadvantages of using microwave signal? [3+5]

2. By assuming a complex inductive load of an antenna which is mismatched with the line impedance of 78.0 ohm, design a double-stub short-circuited matching network. Show both electrical and physical connections. [8+2]

3. Why S-parameter is important in microwave network analysis? Write down the properties of a 3-port network. [4+4]

4. Suppose there are two identical radar transmitters and few passive devices in equipment stock. A particular application requires twice more input power to an antenna than either transmitter can deliver. As a RF engineer, give your appropriate solution for the above problem with necessary figures, mathematics and sufficient explanation. [8]

5. What do you mean by slow backward wave structure? Explain the construction and working principle of a LNA. [2+6]

6. Show a flow diagram that explain designing of an amplifier using a FET transistor. With self-defined parameters and the help of a smith chart define conditional stability of a microwave amplifier. [10]

7. Justify and describe how a microwave filter is designed using insertion loss method. [2+6]

8. Define major microwave measurement parameters and explain the working principle of a low microwave power measurement device. [8]

9. Write short notes on: (any two) [2×6]

   a) RF/MW radiation hazards and safety practices
   b) Directional Couplers
   c) TE mode circular wave guide

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Supplied Formulas:

$$K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2|S_{12}||S_{21}|}$$

$$\Delta = (S_{11}S_{22} - S_{12}S_{21})$$

$$\mu = \frac{1 - |S_{11}|^2}{|S_{22} - \Delta S^*_{11}| + |S_{21}S_{12}|}$$

$$\Gamma = \frac{B_1 \pm \sqrt{B_1^2 - 4|C_1|^2}}{2C_1}$$

$$\Gamma = \frac{B_2 \pm \sqrt{B_2^2 - 4|C_2|^2}}{2C_2}$$

Where, $B_1 = 1 + |S_{11}|^2 - |S_{22}|^2 - |\Delta|^2$

$$B_2 = 1 + |S_{22}|^2 - |S_{11}|^2 - |\Delta|^2$$

$$C_1 = S_{11} - \Delta S^*_{22}$$

$$C_2 = S_{22} - \Delta S^*_{11}$$

$$\Gamma = \frac{(S_{22} - \Delta S^*_{11})}{|S_{22}|^2 - |\Delta|^2}$$

$$\Gamma = \frac{(S_{11} - \Delta S^*_{22})}{|S_{11}|^2 - |\Delta|^2}$$

$$R_L = \frac{|S_{12}S_{21}|}{|S_{22}|^2 - |\Delta|^2}$$

$$R_S = \frac{|S_{12}S_{21}|}{|S_{11}|^2 - |\Delta|^2}$$

$$G_{Tmax} = \left(\frac{1}{1 - |\Gamma_S|^2}\right)|S_{21}|^2\left(\frac{1 - |\Gamma_L|^2}{|1 - S_{22}\Gamma_L|^2}\right)$$

For unilateral mode $S_{12} = 0$, $\Gamma_S = S^*_{11}$ and $\Gamma_L = S^*_{22}$

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - RF and Microwave Engineering *(EX 752)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ __Necessary Formulas and Smith Charts are attached herewith.__
✓ Assume suitable data if necessary.

1. Differentiate between lumped and distributed circuit analysis. What are the uses of microwave bands? [4+2]

2. Assume an inductive load impedance is connected to a mismatched 50Ω transmission line. Find the size and placement of the matching stub that will remove all the standing waves and match load to the line. Use double stub shunt tuning short and open circuited stub. Draw its electrical diagram and physical connection. [8]

3. Why we use S-parameters for microwave analysis? Define S-matrix for 3 port network with appropriate example. [4+4]

4. Choose a suitable passive microwave device to split power into half and explain its properties. [8]

5. Explain what is bunching effect. Explain the working principle of BWO with neat diagrams. [2+8]

6. Check the stability and find the maximum gain a transistor amplifier having $S_{11} = 0.64\angle-169°$, $S_{12} = 0.03\angle50°$, $S_{21} = 10.11\angle91°$, $S_{22} = 0.22\angle-82°$. Consider both bilateral and unilateral model. Modify the S-parameters if necessary. [12]

7. Describe insertion loss method of microwave filter design. Illustrate an example of a passive LPF using µ-strip. [8+2]

8. Describe the working principle of a network analyzer. [8]

9. Write short notes on: (Any two) [2×5]
   a) Microwave Circulators
   b) TM mode for rectangular waveguides
   c) Microwave radiation hazards

***

Supplied Formulas:

$$K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2|S_{12}||S_{21}|}$$

$$\Delta = (S_{11}S_{22} - S_{12}S_{21})$$

$$\mu = \frac{1 - |S_{11}|^2}{|S_{22} - \Delta S^*_{11}| + |S_{21}S_{12}|}$$

$$\Gamma_S = \frac{B_1 \pm \sqrt{B_1{}^2 - 4|C_1|^2}}{2C_1}$$

$$\Gamma_L = \frac{B_2 \pm \sqrt{B_2{}^2 - 4|C_2|^2}}{2C_2}$$

Where, $B_1 = 1 + |S_{11}|^2 - |S_{22}|^2 - |\Delta|^2$,

$$B_2 = 1 + |S_{22}|^2 - |S_{11}|^2 - |\Delta|^2$$

$$C_1 = S_{11} - \Delta S^*_{22}$$

$$C_2 = S_{22} - \Delta S^*_{11}$$

$$C_L = \frac{(S_{22} - \Delta S^*_{11})}{|S_{22}|^2 - |\Delta|^2}$$

$$C_S = \frac{(S_{11} - \Delta S^*_{22})}{|S_{11}|^2 - |\Delta|^2}$$

$$R_L = \frac{|S_{12}S_{21}|}{|S_{22}|^2 - |\Delta|^2}$$

$$R_S = \frac{|S_{12}S_{21}|}{|S_{11}|^2 - |\Delta|^2}$$

$$G_{Tmax} = \left(\frac{1}{1 - |\Gamma_S|^2}\right) |S_{21}|^2 \left(\frac{1 - |\Gamma_L|^2}{|1 - S_{22}\Gamma_L|^2}\right)$$

For unilateral mode $S_{12} = 0$, $\Gamma_S = S^*_{11}$ and $\Gamma_L = S^*_{22}$

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - RF and Microwave Engineering (EX752)

✓ Candidates are required to give their answers in their own words as far as practicable.—
✓ Attempt *All* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ *Necessary Formulas and Smith Charts are attached herewith.*
✓ Assume suitable data if necessary.

1. What are the merits and demerits of microwaves compared to seismic wave? [5]

2. Compare RF radiation fields and explain how they are hazardous to living body. [5]

3. Sketch an immittance chart and compare the scales. [5]

4. Design a signal shunt and open matching networks using Smith Chart for a transmission line having surge impedance of 75 Ohm and load impedance of 78.27 + j60.93 Ohm. Sketch the physical diagram considering microstrips. [4+4+2]

5. You are supposed to measure about 7.5 mW of microwave power. Choose a proper power measuring device and explain its working principle. [10]

6. What is cross-field effect? Design and describe the working principle of a cross field cavity device for power amplifier. Consider a 90° phase shift between adjacent cavities. [3+7]

7. Describe magic Tee based on S-parameters. Differentiate between dominant and degenerate modes. Consider a rectangular waveguide having dimension of a = 3b and find the dominant mode among TM_{01}, TM_{10}, TM_{11} TM_{21} TM_{12} TM_{02} and TM_{20}. [6+2+2]

8. A GaAs FET transistor has the S-Parameters at 5 GHz with 50 Ohm line measured as $S_{11} = 0.45 L163°$, $S_{12} = 0.04 L40°$, $S_{21} = 2.55 L{-106}°$ and $S_{22} = 0.46 L{-65}°$. Check the stability and find the maximum power gain using this transistor. [10]

9. Write short note on: (any three) [3×5]

   a) Microwave filter parameters and LPF prototyping
   b) TM mode rectangular wave guide
   c) Bunching effect in reflex klystron
   d) Microwave mixer

***

Supplied Formula

$$K = \frac{1 - |S_{11}|^2 - |S_{22}|^2 + |\Delta|^2}{2|S_{12}S_{21}|} \qquad \mu = \frac{1 - |S_{11}|^2}{|S_{22} - S_{11}^* \Delta| + |S_{12}S_{21}|}$$

$$\Delta = S_{11}S_{22} - S_{12}S_{21}$$

$$\Gamma_S = \frac{B_1 \pm \sqrt{B_1^2 - 4|C_1|^2}}{2C_1} \qquad \Gamma_L = \frac{B_2 \pm \sqrt{B_2^2 - 4|C_2|^2}}{2C_2}$$

$$R_L = \left| \frac{S_{12}S_{21}}{|S_{22}|^2 - |\Delta|^2} \right| \qquad B_1 = 1 + |S_{11}|^2 - |S_{22}|^2 - |\Delta|^2 \qquad C_1 = S_{11} - \Delta S_{22}^*$$

$$B_2 = 1 + |S_{22}|^2 - |S_{11}|^2 - |\Delta|^2 \qquad C_2 = S_{22} - \Delta S_{11}^*$$

$$C_L = \frac{(S_{22} - \Delta S_{11}^*)^*}{|S_{22}|^2 - |\Delta|^2} \qquad G_{TU} = \frac{|S_{21}|^2 \left(1 - |\Gamma_S|^2\right)\left(1 - |\Gamma_L|^2\right)}{|1 - S_{11}\Gamma_S|^2 \, |1 - S_{22}\Gamma_L|^2}$$

$$R_S = \left| \frac{S_{12}S_{21}}{|S_{11}|^2 - |\Delta|^2} \right| \qquad G_T = \frac{|S_{21}|^2 \left(1 - |\Gamma_S|^2\right)\left(1 - |\Gamma_L|^2\right)}{|1 - \Gamma_S\Gamma_{in}|^2 \, |1 - S_{22}\Gamma_L|^2}$$

$$C_S = \frac{(S_{11} - \Delta S_{22}^*)^*}{|S_{11}|^2 - |\Delta|^2}$$

Supplied Formula

Design For Maximum Gain (Conjugate Matching)

$$\Gamma_{in} = \Gamma_S^*$$
$$\Gamma_{out} = \Gamma_L^*$$

$$G_{Tmax} = \frac{1}{1 - |\Gamma_S|^2} |S_{21}|^2 \frac{1 - |\Gamma_L|^2}{|1 - S_{22}\Gamma_L|^2}$$

$$\Gamma_S = \frac{B_1 \pm \sqrt{B_1^2 - 4|C_1|^2}}{2C_1} \qquad \Gamma_L = \frac{B_2 \pm \sqrt{B_2^2 - 4|C_2|^2}}{2C_2}$$

$$B_1 = 1 + |S_{11}|^2 - |S_{22}|^2 - |\Delta|^2 \qquad C_1 = S_{11} - \Delta S_{22}^*$$

$$B_2 = 1 + |S_{22}|^2 - |S_{11}|^2 - |\Delta|^2 \qquad C_2 = S_{22} - \Delta S_{11}^*$$

For Unilateral $S_{12} = 0, \Gamma_S = S_{11}^*$ and $\Gamma_L = S_{22}^*$

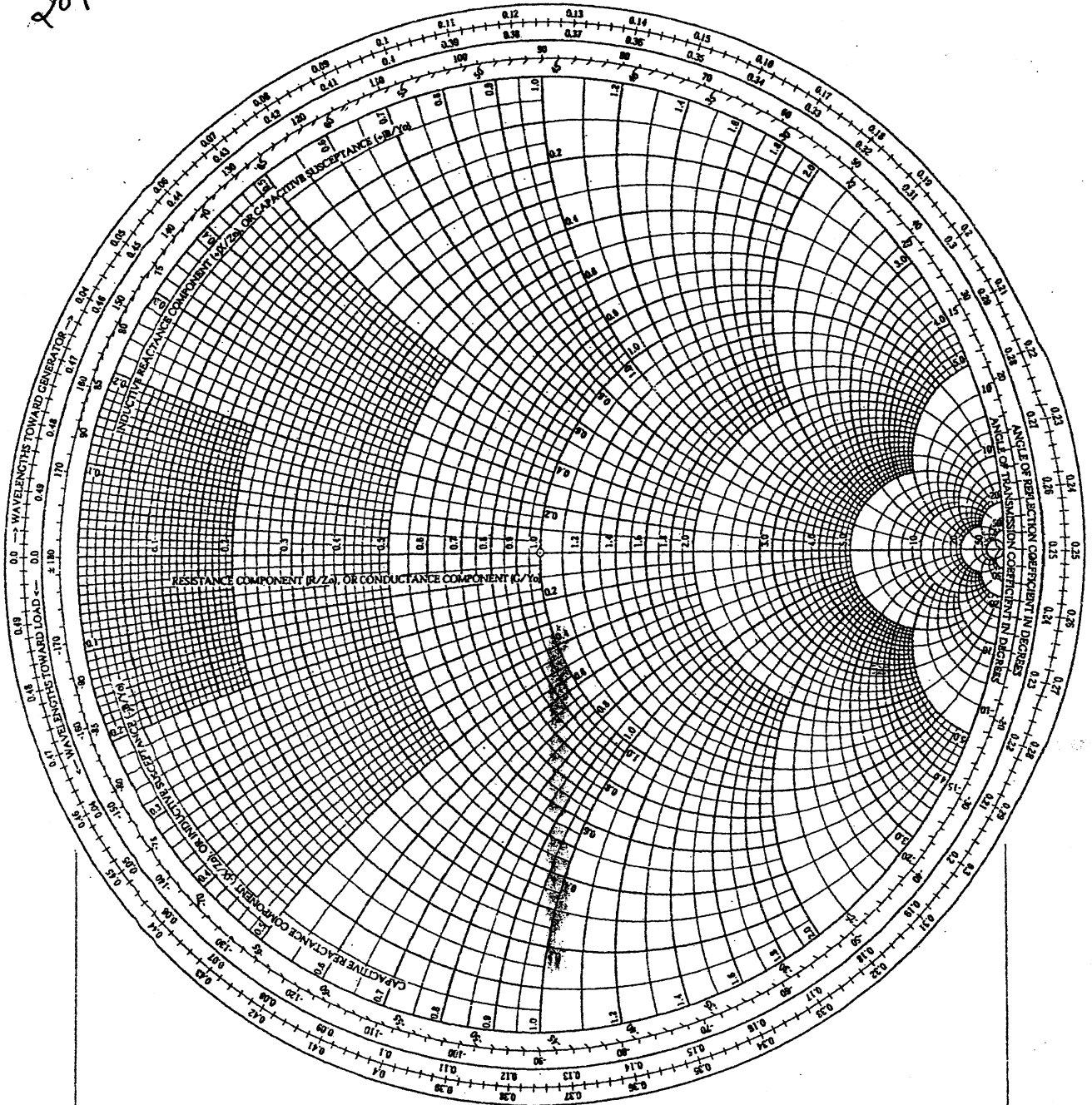$$G_{TUmax} = \frac{1}{1 - |S_{11}|^2} |S_{21}|^2 \frac{1}{1 - |S_{22}|^2}$$

$$R_S = \left| \frac{S_{12}S_{21}}{|S_{11}|^2 - |\Delta|^2} \right| \qquad K = \frac{1 - |S_{11}|^2 - |S_{22}|^2 + |\Delta|^2}{2|S_{12}S_{21}|}$$

$$\mu = \frac{1 - |S_{11}|^2}{|S_{22} - S_{11}^* \Delta| + |S_{12}S_{21}|} \qquad \Delta = S_{11}S_{22} - S_{12}S_{21}$$
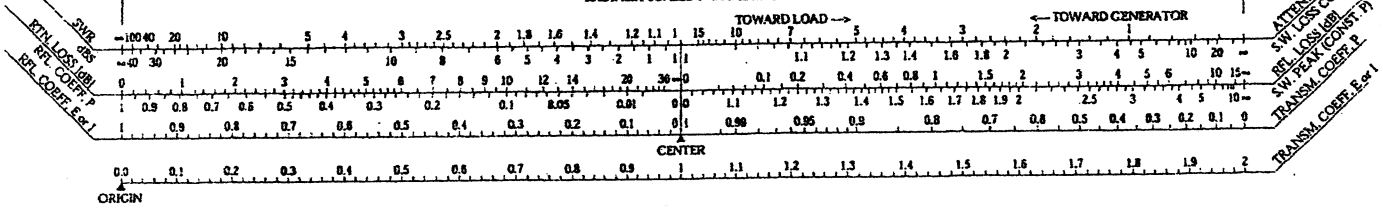
The Complete Smith Chart

Black Magic Design

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RADIALLY SCALED PARAMETERS

TOWARD LOAD —→   ←— TOWARD GENERATOR

CENTER

ORIGIN

Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - RF and Microwave Engineering (EX752)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt All questions.
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✓ Necessary Formulas and Smith Charts are attached herewith.
✓ Assume suitable data if necessary.

1. What are the advantages and disadvantages of microwaves over acoustic waves? [5]

2. What is admittance chart? A load impedance of $Z_L = 80+j100$ is connected to a microstrip transmission line. Find the size and placement of the matching stub. Use single stub shunt tuning short and open stubs. [2+8]

3. Define the use of S-parameters for three-port analysis. Define the term return loss and insertion loss. [5+2]

4. What are waveguide junctions? Describe the operational principles of magic tee based on s-parameters. [3+3]

5. What is density modulation? Describe the working principle of a multi-cavity klystron oscillator. [2+7]

6. Justify that a transistor having following S-parameters $S_{11} = 0.894 \angle -60.6°$, $S_{12} = 0.020 \angle 62.4°$, $S_{21} = 3.122 \angle 123.6°$ and $S_{22} = 0.781 \angle -27.6°$ is conditionally stable while designing an amplifier. Considering unilateral model calculate maximum gain. [5+5]

7. How can you implement low pass filter using micro-strip? How they are prototyped? [3+5]

8. Describe how standing waves and microwave powers are measured with VSWR meter and low power measurement. [2+8]

9. Write short notes on: (any three) [3×5]

   a) Dominant mode in waveguide
   b) Circulators
   c) LNA cavity device inserting loss method for filter designing
   d) Insertion loss method for filter designing

--

Supplied Formula

$$K = \frac{1 - |S_{11}|^2 - |S_{22}|^2 + |\Delta|^2}{2|S_{12}S_{21}|}$$

$$\mu = \frac{1 - |S_{11}|^2}{|S_{22} - S_{11}^*\Delta| + |S_{12}S_{21}|}$$

$$\Delta = S_{11}S_{22} - S_{12}S_{21}$$

$$\Gamma_s = \frac{B_1 \pm \sqrt{B_1^2 - 4|C_1|^2}}{2C_1} \qquad \Gamma_L = \frac{B_2 \pm \sqrt{B_2^2 - 4|C_2|^2}}{2C_2}$$

$$R_L = \left| \frac{S_{12}S_{21}}{|S_{22}|^2 - |\Delta|^2} \right|$$

$$B_1 = 1 + |S_{11}|^2 - |S_{22}|^2 - |\Delta|^2 \qquad C_1 = S_{11} - \Delta S_{22}^*$$

$$B_2 = 1 + |S_{22}|^2 - |S_{11}|^2 - |\Delta|^2 \qquad C_2 = S_{22} - \Delta S_{11}^*$$

$$C_L = \frac{(S_{22} - \Delta S_{11}^*)^*}{|S_{22}|^2 - |\Delta|^2} \qquad G_{TU} = \frac{|S_{21}|^2 (1 - |\Gamma_S|^2)(1 - |\Gamma_L|^2)}{|1 - S_{11}\Gamma_S|^2 |1 - S_{22}\Gamma_L|^2}$$

$$R_s = \left| \frac{S_{12}S_{21}}{|S_{11}|^2 - |\Delta|^2} \right| \qquad G_T = \frac{|S_{21}|^2 (1 - |\Gamma_S|^2)(1 - |\Gamma_L|^2)}{|1 - \Gamma_S \Gamma_{in}|^2 |1 - S_{22}\Gamma_L|^2}$$

$$C_s = \frac{(S_{11} - \Delta S_{22}^*)^*}{|S_{11}|^2 - |\Delta|^2}$$

Supplied Formula

Design For Maximum Gain (Conjugate Matching)

$$\Gamma_{in} = \Gamma_S^*$$

$$\Gamma_{out} = \Gamma_L^*$$

$$G_{Tmax} = \frac{1}{1 - |\Gamma_S|^2} |S_{21}|^2 \frac{1 - |\Gamma_L|^2}{|1 - S_{22}\Gamma_L|^2}$$

$$\Gamma_s = \frac{B_1 \pm \sqrt{B_1^2 - 4|C_1|^2}}{2C_1} \qquad \Gamma_L = \frac{B_2 \pm \sqrt{B_2^2 - 4|C_2|^2}}{2C_2}$$

$$B_1 = 1 + |S_{11}|^2 - |S_{22}|^2 - |\Delta|^2 \qquad C_1 = S_{11} - \Delta S_{22}^*$$

$$B_2 = 1 + |S_{22}|^2 - |S_{11}|^2 - |\Delta|^2 \qquad C_2 = S_{22} - \Delta S_{11}^*$$

For Unilateral $S_{12} = 0, \Gamma_S = S_{11}^*$ and $\Gamma_L = S_{22}^*$

$$G_{TUmax} = \frac{1}{1 - |S_{11}|^2} |S_{21}|^2 \frac{1}{1 - |S_{22}|^2}$$

$$R_s = \left| \frac{S_{12}S_{21}}{|S_{11}|^2 - |\Delta|^2} \right| \qquad K = \frac{1 - |S_{11}|^2 - |S_{22}|^2 + |\Delta|^2}{2|S_{12}S_{21}|}$$

$$\mu = \frac{1 - |S_{11}|^2}{|S_{22} - S_{11}^*\Delta| + |S_{12}S_{21}|} \qquad \Delta = S_{11}S_{22} - S_{12}S_{21}$$

4

Exam.	**Regular / Back**		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs .

Subject: - RF and Microwave Engineering *(EX752)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ __Necessary formulas and Smith Charts are attached herewith.__
✓ Assume suitable data if necessary.

1. Describe field equations and other related parameters of a rectangular waveguide in TM mode. Compare TE_{10} and TE_{20} in terms of cut-off frequency and dominant mode.   [8+2]

2. Design a double stub matching network using three-eighths wavelength $\left(\dfrac{3\lambda}{8}\right)$ separation that match an antenna having load of 300+j300 Ohm connected to a 300 Ohm transmission line.   [10] Justify your design.

3. What is bunching effect? Describe the working principle of a klystron oscillator.   [2+8]

4. Using the given S-parameters $S_{11}=0.55\angle150°, S_{12}=0.04\angle20°, S_{21}=2.82\angle180°, S_{22}=0.45\angle-30°$ and required assumptions, calculate maximum gains of this transistor amplifier for bilateral and unilateral modes.   [10]

5. Draw a flow diagram to describe the design procedure of a microwave amplifier. Define the stability of an amplifier having $C_S=1.15\angle10°$, $R_S=0.85$, $C_L=1.10\angle80°$, $R_L=1.10$.   [5+5]

6. How microwave measurements are different to low frequency measurements? Describe how static calorimeter works to measure power.   [3+7]

7. Design a two-port network model and derive the required parameters.   [10]

8. Write short notes (Any TWO)   [2x5]
   a. Design procedures of microwave filters
   b. Microwave radiation hazards and safety practices
   c. Backward Wave Oscillator
   d. Merits of S-parameters in microwaves

***

Supplied Formulas:

$$K = \frac{1+|\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2|S_{12}||S_{21}|},$$

$$\Delta = (S_{11}S_{22}) - (S_{12}S_{21}),$$

$$\mu = \frac{1-|S_{11}|^2}{|S_{22} - \Delta S_{11}^*| + |S_{21}S_{12}|}$$

$$\Gamma_s = \frac{B_1 \pm \sqrt{B_1^2 - 4|C_1|^2}}{2C_1}$$

$$\Gamma_L = \frac{B_2 \pm \sqrt{B_2^2 - 4|C_2|^2}}{2C_2}, \text{ where}$$

$$B_1 = 1+|S_{11}|^2 - |S_{22}|^2 - |\Delta|^2,$$

$$B_2 = 1+|S_{22}|^2 - |S_{11}|^2 - |\Delta|^2,$$

$$C_1 = S_{11} - \Delta S_{22}^*, \text{ and}$$

$$C_2 = S_{22} - \Delta S_{11}^*$$

$$C_L = \frac{(S_{22} - \Delta S_{11}^*)^*}{|S_{22}|^2 - |\Delta|^2}$$

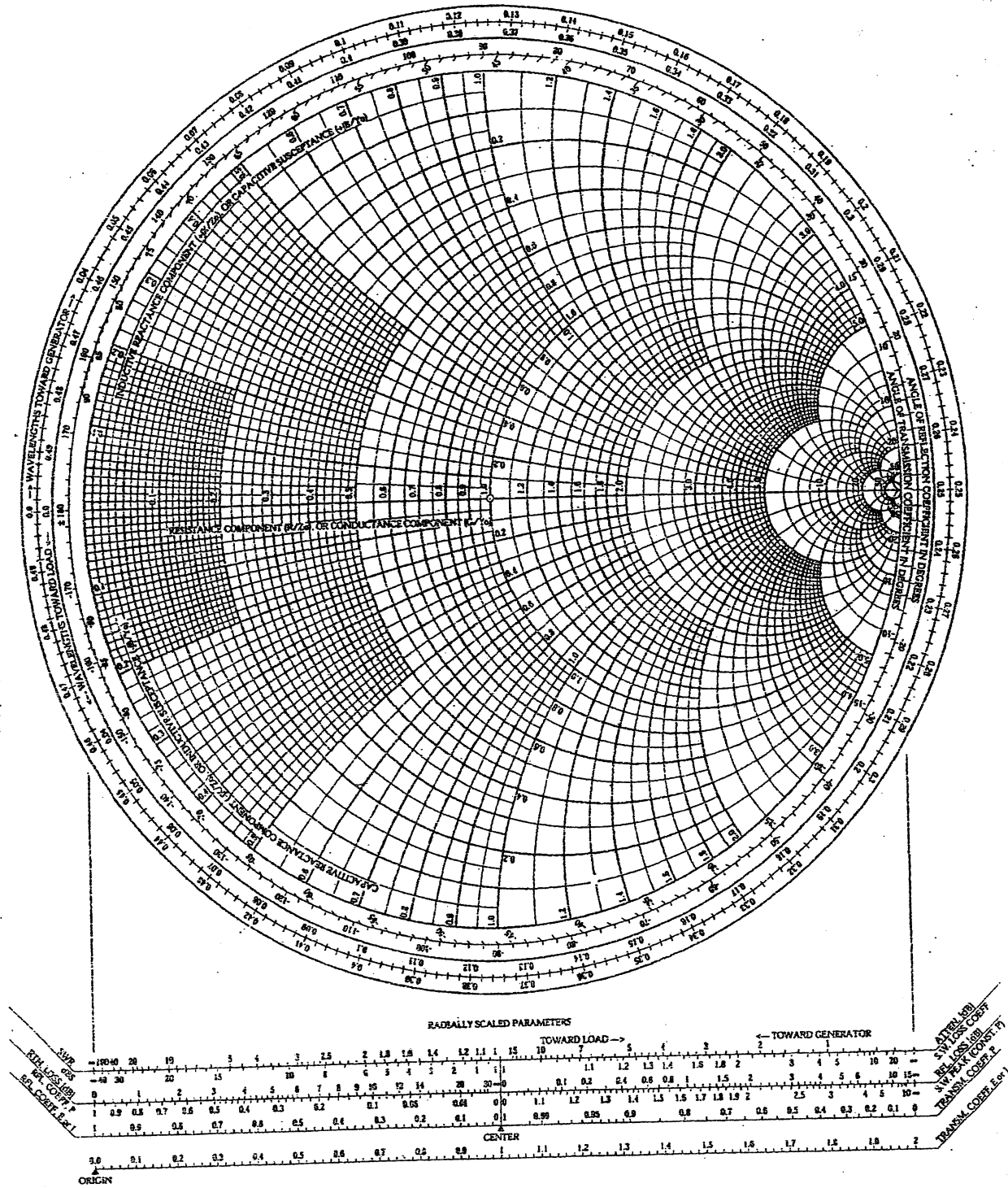$$C_S = \frac{(S_{11} - \Delta S_{22}^*)^*}{|S_{11}|^2 - |\Delta|^2}$$

$$R_L = \frac{|S_{12}S_{21}|}{|S_{22}|^2 - |\Delta|^2}$$

$$R_S = \frac{|S_{12}S_{21}|}{|S_{11}|^2 - |\Delta|^2}$$

$$G_{Tmax} = \left(\frac{1-|\Gamma_S|^2}{|1-S_{11}\Gamma_S|^2}\right)|S_{21}|^2\left(\frac{1-|\Gamma_L|^2}{|1-S_{22}\Gamma_L|^2}\right)$$

The Complete Smith Chart

Black Magic Design

RADIALLY SCALED PARAMETERS

Subject: - RF and Microwave Engineering (EX752)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ __Necessary figures and Smith Charts are attached herewith.__
✓ Assume suitable data if necessary.

1. Differentiate the behaviors of the systems at microwave and conventional low frequency bands. [6]

2. Describe how TE mode is different from TM mode in a circular waveguide. [10]

3. Describe the working principle of a cavity magnetron. [10]

4. Why S-parameter is important in microwave network analysis? Define S-parameters for a two-port network. [4+5]

5. By arbitrarily assuming a suitable load that connects to a 50-ohm transmission line find the lengths and spacing for a two-stub impedance matching system. Assume also a suitable separation between the stubs. [10]

6. Using the following S-parameters of $S_{11}=0.55\angle-150°$, $S_{12}=0.04\angle20°$, $S_{21}=2.82\angle180°$ and $S_{22}=0.45\angle-30°$, calculate and compare maximum power gain for unilateral and bilateral modes. [15]

7. Discuss the difference between an amplifier circuit and an oscillator circuit in terms of stability factor. [5]

8. Write short notes (Any THREE) [3 x 5]
   a. Microwave magic tee
   b. Microwave radiation fields
   c. Microwave strip-lines against micro-strips
   d. Static calorimeter

***

Supplied Formulas:

$$K = \frac{1+|\Delta|^2-|S_{11}|^2-|S_{22}|^2}{2|S_{12}||S_{21}|}$$

$$\Delta = (S_{11}S_{22})-(S_{12}S_{21}),$$

$$\mu = \frac{1-|S_{11}|^2}{|S_{22}-\Delta S_{11}^*|+|S_{12}S_{21}|}$$

$$\Gamma_s = \frac{B_1 \pm \sqrt{B_1^2-4|C_1|^2}}{2C_1},$$

$$\Gamma_L = \frac{B_2 \pm \sqrt{B_2^2-4|C_2|^2}}{2C_2}, \text{ where :}$$

$$B_1 = 1+|S_{11}|^2-|S_{22}|^2-|\Delta|^2,$$

$$B_2 = 1+|S_{22}|^2-|S_{11}|^2-|\Delta|^2,$$

$$C_1 = S_{11}-\Delta S_{22}^*, \text{ and}$$

$$C_2 = S_{22}-\Delta S_{11}^*,$$

$$C_L = \frac{(S_{22}-\Delta S_{11}^*)}{|S_{22}|^2-|\Delta|^2},$$

$$C_s = \frac{(S_{11}-\Delta S_{22}^*)}{|S_{11}|^2-|\Delta|^2},$$

$$R_L = \frac{|S_{12}S_{21}|}{|S_{22}|^2-|\Delta|^2},$$

$$R_s = \frac{|S_{12}S_{21}|}{|S_{11}|^2-|\Delta|^2},$$

$$G_{Tmax} = \left(\frac{1-|\Gamma_s|^2}{|1-S_{11}\Gamma_s|^2}\right)|S_{21}|^2\left(\frac{1-|\Gamma_L|^2}{|1-S_{22}\Gamma_L|^2}\right)$$

Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - RF and Microwave Engineering (EX752)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
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✓ Assume suitable data if necessary.

1. Based on operational principles, compare microwave systems with conventional low frequency systems. Lists the areas of application of microwave systems. [4+4]

2. What makes S-parameters useful in microwave network analysis? Define S-parameters for a two-port network. Justify that the Butterworth and Chebyshev filter responses are common to prototype microwave two-port filter network using insertion loss method. [4+4+4]

3. Design a double-stub impedance matching network for a given load of $80 + j180$ Ohm connected to a 100-Ohm transmission line at 3 GHz with a three-eights wavelength separation between the stubs. Illustrate necessary diagrams to show physical connections. [8+2]

4. Define expressions for various field components of a rectangular waveguide in TE mode. Show that a 1 GHz signal cannot propagate in TE_{10} made in a rectangular waveguide with a wall separation of 5 cm. [7+3]

5. Find the maximum gain for a microwave transistor amplifier with $S_{11} = 0.656\angle146.7°$, $S_{12} = 0.122\angle46.1°$, $S_{21} = 2.3\angle44.7°$, $S_{22} = 0.172\angle-117.1°$. [10]

6. What is bunching effect? Briefly describe the construction and operational features of a cavity magnetron. [2+8]

7. Describe how standing waves and microwave powers are measured with VSWR meter and bolometry respectively. [4+6]

8. Write short notes on: (any two) [2×5]

   a) Mixer theory
   b) Circulators
   c) Microwave radiation hazards and safety practices

***

Supplied Formulas:

$$K = \frac{1+|\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2|S_{12}||S_{21}|}$$

$$\Delta = (S_{11}S_{22}) - (S_{12}S_{21}),$$

$$\mu = \frac{1-|S_{11}|^2}{|S_{22} - \Delta S_{11}^*| + |S_{21}S_{12}|}$$

$$\Gamma_s = \frac{B_1 \pm \sqrt{B_1^2 - 4|C_1|^2}}{2C_1}$$

$$\Gamma_L = \frac{B_2 \pm \sqrt{B_2^2 - 4|C_2|^2}}{2C_2}, \text{ where}$$

$$B_1 = 1 + |S_{11}|^2 - |S_{22}|^2 - |\Delta|^2,$$

$$B_2 = 1 + |S_{22}|^2 - |S_{11}|^2 - |\Delta|^2,$$

$$C_1 = S_{11} - \Delta S_{22}^*, \text{ and}$$

$$C_2 = S_{22} - \Delta S_{11}^*$$

$$C_L = \frac{(S_{22} - \Delta S_{11}^*)^*}{|S_{22}|^2 - |\Delta|^2}$$

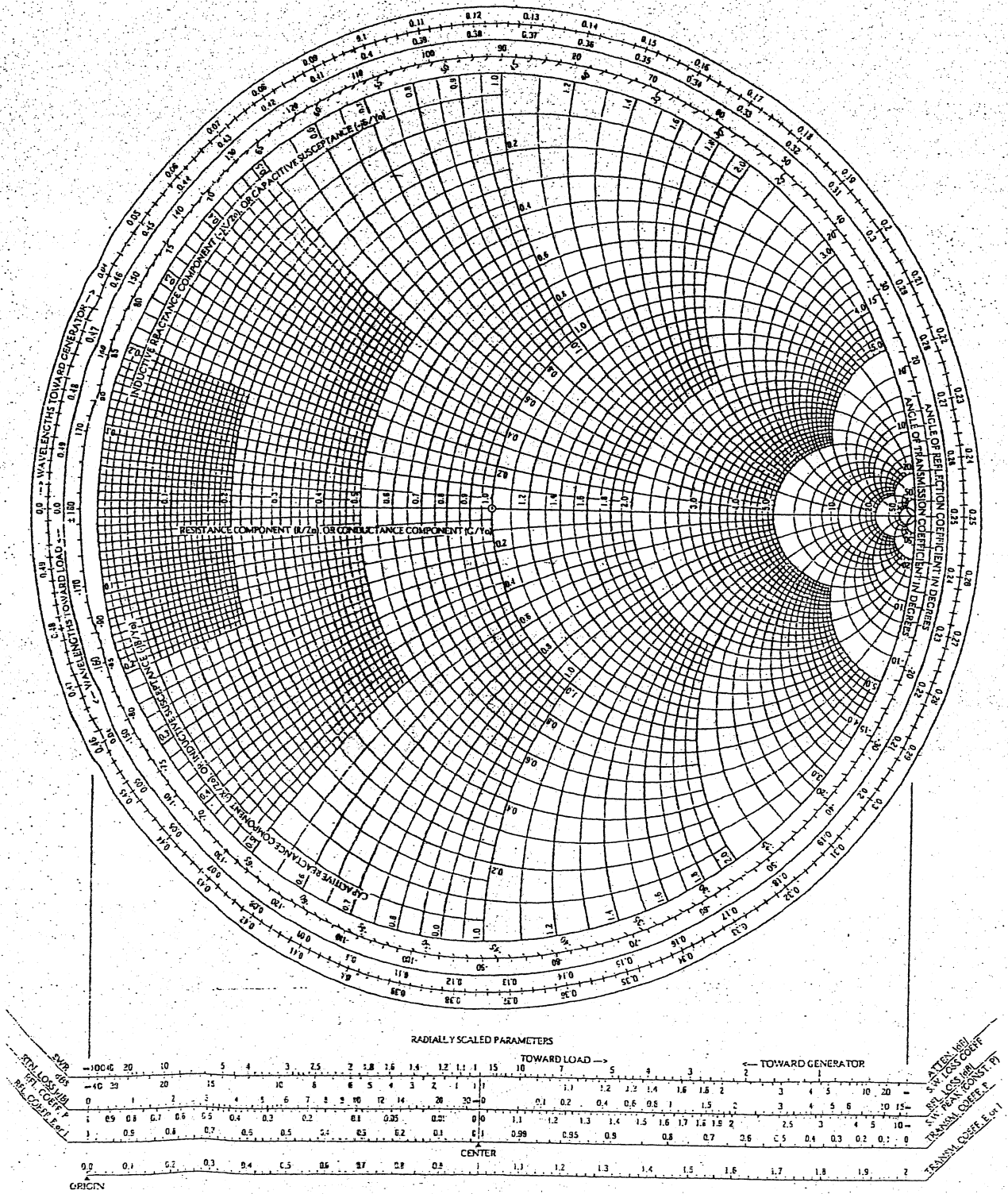$$C_s = \frac{(S_{11} - \Delta S_{22}^*)^*}{|S_{11}|^2 - |\Delta|^2}$$

$$R_L = \frac{|S_{12}S_{21}|}{|S_{22}|^2 - |\Delta|^2}$$

$$R_s = \frac{|S_{12}S_{21}|}{|S_{11}|^2 - |\Delta|^2}$$

$$G_{T\max} = \left(\frac{1}{1-|\Gamma_s|^2}\right)|S_{21}|^2\left(\frac{1-|\Gamma_L|^2}{|1-S_{22}\Gamma_L|^2}\right)$$

The Complete Smith Chart

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RADIALLY SCALED PARAMETERS

CENTER

ORIGIN

34   TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Magh

Exam.	**New Back (2066 & Later Batch)**		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - RF and Microwave Engineering *(EX752)*

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✓ Attempt *All* questions.
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✓ Assume suitable data if necessary.

1. Differentiate between conventional low frequency and microwave systems based on their working principles. Lists the area of application of microwave systems. [4+4]

2. Justify that S-parameters are used in microwaves instead of h-parameters for network analysis. Define S-parameter for a two-port network. Why the Butterworth and Chebyshev filter responses are common to prototype microwave two-port filter network insertion loss method? [4+4+4]

3. Design a double-stub impedance matching network for a given load of $190+j\,110$ Ohms connected to be 100-Ohm transmission line at 10 GHz with a three-eight wavelength separation between the stubs. Illustrate necessary diagrams to show physical connections. [8+2]

4. Define expressions for various field components of a rectangular waveguide in TM mode. Prove that TM_{01} and TM_{10} modes do not exist in a rectangular waveguide. [7+3]

5. Justify that a transistor having following S-parameters $S_{11} = 0.894\angle-60.6°$, $S_{12} = 0.020\angle62.4°$, $S_{21} = 3.122\angle123.6°$ and $S_{22} = 0.781\angle-27.6°$ is conditionally stable while designing an amplifier. [10]

6. What is transit time effect? Briefly describe the construction and principle of operation of a two-cavity klystron amplifier. [2+8]

7. What is calorimetry in microwave? Differentiate between circulating and flow calorimetries based on principles of operation. [2+8]

8. Write short notes: (any two) [2+8]

   a) Hybrid tee
   b) Microwave oscillator theory
   c) RF radiation hazards and safety standards

***

Supplied Formulas:

$$K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2|S_{12}||S_{21}|},$$

$$\Delta = (S_{11}S_{22}) - (S_{12}S_{21}),$$

$$\mu = \frac{1 - |S_{11}|^2}{|S_{22} - \Delta S_{11}^*| + |S_{21}S_{12}|}$$

$$\Gamma_S = \frac{B_1 \pm \sqrt{B_1^2 - 4|C_1|^2}}{2C_1},$$

$$\Gamma_L = \frac{B_2 \pm \sqrt{B_2^2 - 4|C_2|^2}}{2C_2}, \text{ where}$$

$$B_1 = 1 + |S_{11}|^2 - |S_{22}|^2 - |\Delta|^2,$$

$$B_2 = 1 + |S_{22}|^2 - |S_{11}|^2 - |\Delta|^2,$$

$$C_1 = S_{11} - \Delta S_{22}^*, \text{ and}$$

$$C_2 = S_{22} - \Delta S_{11}^*$$

$$C_L = \frac{(S_{22} - \Delta S_{11}^*)^*}{|S_{22}|^2 - |\Delta|^2}$$

$$C_S = \frac{(S_{11} - \Delta S_{22}^*)^*}{|S_{11}|^2 - |\Delta|^2}$$

$$R_L = \frac{|S_{12}S_{21}|}{|S_{22}|^2 - |\Delta|^2}$$

$$R_S = \frac{|S_{12}S_{21}|}{|S_{11}|^2 - |\Delta|^2}$$

$$G_{Tmax} = \left(\frac{1}{1 - |\Gamma_S|^2}\right) |S_{21}|^2 \left(\frac{1 - |\Gamma_L|^2}{|1 - S_{22}\Gamma_L|^2}\right)$$

Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - RF & Microwave Circuits, Systems & Devices (EG785EX) (Elective II)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt _All_ questions.
✓ The figures in the margin indicate _Full Marks_.
✓ _Necessary formulas and smith chart are attached herewith._
✓ Assume suitable data if necessary.

1. Classify microwave frequency bands and state their major applications. Describe how microwave transmission lines are different from the conventional low frequency transmission lines.
[4+4]

2. Describe microwave radiation hazards based on the radiation fields.
[8]

3. Describe rectangular waveguide based on modes on propagation and other critical parameters.
[8]

4. Describe why S-parameter is important in microwave network analysis. Using a two-port network derive S-parameters.
[4+6]

5. What is double-stub tuner? Assuming a load of 75 + $j75$ ohm is connected to a 50-ohm transmission line, find the lengths and spacing for a two-stub impedance matching system with three-eights wavelength separation between the stubs.
[3+15]

6. Design an amplifier to attain maximum gain at 4.0 GHz using a GaAs FET having following S-parameters: $S_{11} = 0.72\angle-116°$, $S_{12} = 0.03\angle57°$, $S_{21} = 2.60\angle76°$ and $S_{22} = 0.73\angle-54°$. Consider the characteristic impedance, $Z_o = 50$ Ohm.
[18]

7. Write short notes (Any TWO)
   a. E-plane tee against H-plane tee
   b. PROBE-coupling against LOOP-coupling
   c. Microstrips
   d. Two-cavity klystron

[2 x 5]

***

Supplied Formulas:

$$K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2|S_{12}||S_{21}|},$$

$$\Delta = (S_{11}S_{22}) - (S_{12}S_{21}),$$

$$\mu = \frac{1 - |S_{11}|^2}{|S_{22} - \Delta S_{11}^*| + |S_{21}S_{12}|}$$

$$\Gamma_s = \frac{B_1 \pm \sqrt{B_1^2 - 4|C_1|^2}}{2C_1},$$

$$\Gamma_L = \frac{B_2 \pm \sqrt{B_2^2 - 4|C_2|^2}}{2C_2}, \text{ where}$$

$$B_1 = 1 + |S_{11}|^2 - |S_{22}|^2 - |\Delta|^2,$$

$$B_2 = 1 + |S_{22}|^2 - |S_{11}|^2 - |\Delta|^2,$$

$$C_1 = S_{11} - \Delta S_{22}^*, \text{ and}$$

$$C_2 = S_{22} - \Delta S_{11}^*$$

$$C_L = \frac{(S_{22} - \Delta S_{11}^*)^*}{|S_{22}|^2 - |\Delta|^2}$$

$$C_S = \frac{(S_{11} - \Delta S_{22}^*)^*}{|S_{11}|^2 - |\Delta|^2}$$

$$R_L = \frac{|S_{12}S_{21}|}{|S_{22}|^2 - |\Delta|^2}$$

$$R_S = \frac{|S_{12}S_{21}|}{|S_{11}|^2 - |\Delta|^2}$$

$$G_{Tmax} = \left(\frac{1}{1 - |\Gamma_s|^2}\right)|S_{21}|^2\left(\frac{1 - |\Gamma_L|^2}{|1 - S_{22}\Gamma_L|^2}\right)$$

Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - RE Microwave Circuits, System and Devices *(Elective I)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ __Necessary figures and Smith Charts are attached herewith.__
✓ Assume suitable data if necessary.

1. Classify microwave frequency bands and describe their major areas of application.   [4+4]

2. Define reactive-, near- and far-field radiations. Describe common RF radiation safety standards.   [4+4]

3. Describe how microwave power measurements are done with bolometer.   [8]

4. Why S-parameters are used in microwaves? Using a two-port network define S-parameters.   [5+5]

5. Assuming a load of 75 + $j75$ ohm is connected to a 50-ohm transmission line, find the lengths and spacing for a two-stub impedance matching system with three-eights wavelength separation between the stubs.   [18]

6. Determine stability and plot stability circles for a microwave transistor with the following S-parameters $S_{11} = 0.8 \angle{-90°}$, $S_{12} = 0.3 \angle{70°}$, $S_{21} = 5.1 \angle{80°}$ and $S_{22} = 0.62 \angle{-40°}$. Find the maximum gain.   [14+4]

7. Write short notes (Any TWO)   [2 x 5]
   a. PIN diode
   b. Magnetrons
   c. Losses in RF transmission line
   d. Resonators

***

Supplied Formulas:

$$K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2|S_{12}||S_{21}|},$$

$$\Delta = (S_{11}S_{22}) - (S_{12}S_{21}),$$

$$\mu = \frac{1 - |S_{11}|^2}{|S_{22} - \Delta S_{11}^*| + |S_{21}S_{12}|}$$

$$\Gamma_S = \frac{B_1 \pm \sqrt{B_1^2 - 4|C_1|^2}}{2C_1};$$

$$\Gamma_L = \frac{B_2 \pm \sqrt{B_2^2 - 4|C_2|^2}}{2C_2}, \text{ where}$$

$$B_1 = 1 + |S_{11}|^2 - |S_{22}|^2 - |\Delta|^2,$$

$$B_2 = 1 + |S_{22}|^2 - |S_{11}|^2 - |\Delta|^2,$$

$$C_1 = S_{11} - \Delta S_{22}^*, \text{ and}$$

$$C_2 = S_{22} - \Delta S_{11}^*$$

$$C_L = \frac{(S_{22} - \Delta S_{11}^*)^*}{|S_{22}|^2 - |\Delta|^2}$$

$$C_S = \frac{(S_{11} - \Delta S_{22}^*)^*}{|S_{11}|^2 - |\Delta|^2}$$

$$R_L = \frac{|S_{12}S_{21}|}{|S_{22}|^2 - |\Delta|^2}$$

$$R_S = \frac{|S_{12}S_{21}|}{|S_{11}|^2 - |\Delta|^2}$$

$$G_{Tmax} = \left(\frac{1}{1 - |\Gamma_S|^2}\right)|S_{21}|^2\left(\frac{1 - |\Gamma_L|^2}{|1 - S_{22}\Gamma_L|^2}\right)$$

6

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Bhadra

Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEI	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Wireless Communication (EX 715)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt All questions.
✓ The figures in the margin indicate Full Marks.
✓ Assume suitable data if necessary.

1. Define forward and reverse channel. How 5G will be different from 4G mobile communication. [2+2]

2. Define Grade of Service (GoS) and explain how can it be measured in a 'blocked call cleared' type of trunking system. A cellular service provider decides to use a digital TDMA scheme that can tolerate a signal-to-interference ratio of 15 dB in the worst case. The mobile radio channel provided a propagation path loss exponent of n = 3. Find the optimal value of N for (a) Omni-directional antennas, (b) 1200 sectoring, and Ic) 60° sectoring. Comment on your results. [3+5]

3. a) What do you mean by diffraction in radio wave propagation? Derive an expression for phase difference in Fresnel Zone Geometry model of direction. [2+6]

   b) In mobile propagation in a cellular system, find the correction factor and pathloss for a medium size city assuming carrier frequency as 950 MHz, height of transmitting antenna at base station is 45 m, propagation distance between antennas is 10 km and height of receiving antenna in mobile station is 5 m. Compute free space pathloss and compare it with Hata pathloss. [4+4]

4. Mention advantages of digital modulation over analog modulation. Explain the transmission and detection process of GMSK modulation scheme with block diagram and constellation diagram. [2+6]

5. Determine the optimal solution of the weights using MSE algorithm with its appropriate diagram and derivation. [8]

6. What are the characteristics of speech signal? Explain the operation of linear predicative coder. [3+5]

7. a) What do you understand by CDMA? Mention its characteristics, advantages and limitations. [2+6]

   b) Explain working of frequency Hopping Multiple Access with an example. [4]

8. Draw and explain the global System for Mobile (GSM) architecture in brief. [8]

9. Write short notes on: (Any Two) [2×4]

   a) Practical handoff considerations
   b) RAKE receiver
   c) Spectrum regulations

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2077 Chaitra

Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Wireless Communication *(EX 751)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. What are the different features of 4G other than 3G mobile communication system? [5]

2. A mobile radio system where each user averages three calls per hour and each call lasting an average of 5 minutes.

   a) What is traffic intensity for each user?
   b) Find the number of users that could use the system with 1% blocking if only one channel is available.
   c) Find the number of users that could use the system with 1% blocking if five trunked channels are available.
   d) If the number of users you found in (c) is suddenly doubled, what is the new blocking probability of the five channel trunked mobile radio system? Justify whether the performance is acceptable or not. [2+2+2+3]

No. of Trunks (N)	Traffic (A) in erlangs for B%							
	0.1%	0.2%	0.5%	1%	1.2%	3%	5%	7%
1	0.001	0.002	0.005	0.010	0.012	0.031	0.053	0.075
2	0.046	0.065	0.105	0.153	0.168	0.282	0.381	0.470
3	0.194	0.249	0.349	0.455	0.489	0.715	0.899	1.06
4	0.439	0.535	0.701	0.869	0.922	1.26	1.52	1.75
5	0.762	0.900	1.13	1.36	1.43	1.88	2.22	2.50

3. Given a cordless phone operating at 52000 kHz frequency which has a range of 50m. Determine the free space path loss. [6]

4. a) Explain log-distance path loss model. [4]
   b) Employing the Okumura model compute the transmitter and receiver separation distance if median loss is 167 dB when the carrier frequency is 2.1 GHz. Assume height of transmitting antenna is 40 m, height of receiving antenna is 2 m, for a large city. [Amu = 34 dB, Garea = 0 dB] [8]

5. Explain the significance of Coherence Bandwidth and Coherence Time in mobile radio propagation. [4]

6. Why we need M-ary QAM? Compare 16-QAM and 16-PSK using its constellation diagram. [2+6]

7. What do you understand by RAKE Receiver? Explain the working of M branch RAKE receiver. [3+5]

8. Discuss the different characteristics of speech signal. [6]

9. Draw and explain the frame structure for GSM. Explain the working of all traffic and control channels used in GSM. [4+6]

10. a) What are the major disadvantages of spread spectrum system? Explain the implementation of CDMA system with appropriate example. [2+6]
    b) Calculate the number of radio channels available in the FDMA system with following data. A US analog mobile phone system is allocated 12.8 MHz for every simplex band. The total spectrum allocated is 12.8 MHz, the guard bandwidth is 10 KHz and the channel bandwidth is 30 KHz.

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Bhadra

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Wireless Communication *(EX 751)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Briefly describe the evolution of wireless communication from 1G to 4G in terms of technology advancement. [6]

2. Compare and contrast between improper handoff situation and proper handoff situation. Explain cellular concept for N=7. [4+3]

3. a) What are the advantages of two ray propagation model over free space path loss model? Derive the equation of path loss using two ray model with appropriate diagram. [2+6]

   b) Estimate the appropriate distance that should be maintained for reverse link between one BTS and mobile with appropriate link budget diagram.
      i) Mobile is connected to antenna with 20dBi gain, with a transmitting power of 15 dBm and a receive sensitivity of -75dBm.
      ii) BTS is connected to antenna with 5 dBi gain, with a transmitting power of 20dBm and a receive sensitivity of -80dBm.
      iii) Cables in both systems are short, with a loss of 3-dB at each side at 900 MHz frequency of operation.
      Use Okamura's model for mean path loss where G(Area) = 9dB, A_{mu}=43 dB, h_{re}=10m and h_{te}=100m.
      (Link margin (reverse link) = 10 dB). [10]

4. What are MSK and GMSK modulation techniques? What are the advantages of spread spectrum modulation technique in wireless communication? [4+4]

5. Explain how diversity improves the quality of network. Explain the operation of RAKE receiver with appropriate block diagram. [2+4]

6. What are different characteristics of speech signal? Explain linear predictive coder with block diagram. [3+5]

7. Explain the term Multiple Access? What do you mean by near for effect in CDMA an state all possible near for effect mitigation techniques. [5+4]

8. Explain the frame structure of GSM. Differentiate between GSM and CDMA standards. [5+3]

9. Write short notes on: *(Any Two)* [5×2]
   a) Wifi
   b) Regulatory issues
   c) Frequency Hopping Multiple Access (FHMA)

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Exam.		Back	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Wireless Communication (EX751)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Discuss the evolution path from GSM to 3G network with appropriate diagram.   [4]

2. a) Consider a cellular system that employs omnidirectional antennas at cell-sites. In order to increase capacity, each cell is split into 4 smaller cells having a radius that is one-half of the radius of the original cell. How should the transmission power of a split cell be changed to minimize interference? (n=3).   [5]

   b) Define Grade of Service (GOS)? How is hand off processed in cellular system?   [2+4]

3. a) What is meant by coherence time? Classify the fading effects due to Doppler spread.   [3+4]

   b) Consider a 100mW transmitter and free-space propagation between transmitter receiving isotropic antennas. A commercial mobile receiver is used for data transmission with a specified receiver sensitivity of -90 dBm. Calculate the radius of service area at a transmission frequency of 800 MHz if an additional cable loss of 2 is measure between the transmission system and the transmitting antenna.   [6]

4. Explain with block diagram the operation of OFDM and state its advantages in terms of fading.   [6+2]

5. Compare MLSE with other non-linear equalizers? Explain in detail any one application of time diversity.   [2+6]

6. Explain two frequency domain coding method of speech.   [4+4]

7. a) Explain spread spectrum multiple access technique practically used in CDMA.   [4]

   b) State the key differences between TDMA and FDMA.   [4]

8. Explain the operation of each component in Network Switching Subsystem of GSM architecture.   [10]

9. Write short notes on: (Any two)   [5×2]

   a) Indoor propagation model
   b) Regulatory issues related to spectral allocation
   c) Convolutional codes

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Subject: - Wireless Communication *(EX751)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Explain briefly the evolution of different generations of cellular systems. [4]

2. Define handoff margin with appropriate figure. [3]

3. A telephone network company needs to expand its capacity based on demand on a city. A group of engineer was selected to find the solution. Among the solution sectoring and cell splitting were major technique for expansion purpose. Being an cellular planning engineer which option do you think is best and why? [5]

4. What is "small scale fading"? Describe briefly its types in radio propogation. Explain the factors which influence small scale fading. [2+4+4]

5. Determine the smallest symbol period Ts, and thus the greatest symbol rate that must be sent through RF channel with given power delay profile without using an equalizer.

Power [dB]	0	0	-10	-20
Delay [us]	0	50	75	100

   Modulation provides suitable BER performance whenever $\sigma_\tau/T_S \leq 0.1$. [8]

6. Explain any two outdoor propagation models used in mobile ratio environment. [3+3]

7. Explain the transmission and detection process of QPSK modulation technique. [6]

8. Describe a signal processing operation that minimizes the effects of ISI. Explain various space diversity techniques. [2+6]

9. What are the characteristics of speed signal? Explain the operation of linear predictive coder. [2+6]

10. What is space division Multiple Access? Explain any two hybrid spread spectrum multiple access technique which minimizes the effect of near for effect. [2+6]

11. Briefly explain different traffic and control channels used in GSM? [8]

12. Write short notes on: (Any two) [2×3]

    a) Frequency Hopped Multiple Access
    b) Viterbi decording algorithm
    c) Wireless local Area Network (WLAN)

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV/ II	Time	3 hrs.

Subject: - Wireless Communication (EX751)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Compare and contrast the first, second, third and forth generation of mobile communication standards in terms of technology advancement.   [6]

2. a. Why does minimizing reuse distance maximize spectral efficiency of a cellular system?   [4]

   b. For a seven cell reuse pattern, find the minimum distance between centers of co-channel cells. Area of each cell is uniform and is equal to 23 square km.   [4]

3. Estimate the feasibility of a 10-km wireless link in suburban area, with one access point and one client radio, using Okumura model for path loss. The median attenuation value is 20 dB and gain due to environment is 13 dB. The height of access point antenna is 100 m and that of client antennal is 10 m: [12]

   a. Access point is connected to antenna with 5-dBi gain, with a transmitting power of 20-dBm and a receive sensitivity of –80-dBm

   b. Client is connected to antenna with 20-dBi gain, with a transmitting power of 15-dBm and a receive sensitivity of –75-dBm

   c. Cables in both systems are short, with a loss of 3-dB at each side at 2.4-GHz frequency of operation.

4. What is known as scattering? Derive an expression for two ray ground reflected model.   [2+8]

5. Explain the operation of OFDM with an appropriate block diagram.   [8]

6. Why is there a need to implement diversity? Describe the various diversity combining techniques.   [4+6]

7. Describe the operation of any two source coders used in speech coding.   [6]

8. Explain the principle of Frequency Hopping Multiple Access. Briefly describe two hybrid spectrum multiple access technique which can mitigate near-far problem.   [4+6]

9. Write short notes on any two: [5+5]
   a. Specifications of GSM.
   b. Regulatory issues
   c. Convolutional encoding and decoding

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Wireless Communication *(EX 751)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Briefly describe the evolution of wireless communications from second to third generation. [4]

2. a) Explain how cell splitting and sectoring improve coverage and capacity in cellular system? [5]

   b) What is cell dragging? How is hand off processed in cellular system? [2+4]

3. a) Explain in brief the three basic radio wave propagation mechanisms. [3]

   b) Determine the propagation path loss for a radio signal 900 MHz cellular system operating in a large urban city, with a base station transmitter antenna height of 100 m and mobile receiver antenna height of 2m. The mobile unit is located at a distance of 4 km. Use the Hata propagation path loss model. [7]

   (Hints: $L_{50} = 69.55 + 26.16\log f_c - 13.82 \log h_t - \alpha(h_r) + (44.9 - 6.55 \log h_t)\log d$
   $\alpha(h_r) = (1.1\log f_c - 0.7)h_r - (1.56\log f_c - 0.8)$ Small to Medium City
   $8.29(\log 1.54h_r)^2 - 1.1$ (Large City ($f_c \leq 300$MHz)
   $3.2(\log 11.75h_r)^2 - 4.97$ (Large City ($f_c > 300$MHz)

4. Explain QPSK modulation with its appropriate equation, constellation diagram. [7]

5. a) Why equalization is needed in wireless communication? Explain training and tracking modes of operation for adaptive equalizers in detail. [1+3]

   b) What is a RAKE receiver and how it exploits the concept of time diversity? [3]

6. a) With the help of a block diagram explain the operation of a vocoder. [4]

   b) Briefly explain the types frequency domain coding of speech. [4]

7. a) What are the advantages of CDMA cellular system over TDMA cellular system? [4]

   b) With a neat block diagram, explain the operation of Frequency Hopping Spread Spectrum. [4]

8. a) Explain the operation of Network Switching Subsystem in GSM architecture. [4]

   b) With an appropriate block diagram explain pilot and sync channels in IS-95 forward link. [6]

9. Write short notes on: (any three) [3×5]

   a) Rayleigh and Ricean fading distribution
   b) Regulatory issues related to spectral licensing
   c) Viterbi decoding
   d) GSM System Architecture

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TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2073 Magh

Exam.	**New Back (2066 & Later Batch)**		
Level	BE	**Full Marks**	80
Programme	BEX	**Pass Marks**	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Wireless Communication *(EX 751)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

__*Hata Model__
L_{50} *(urban)* (dB) = $69.55 + 26.16\log f_c - 13.82\log h_{te} - a(h_{re}) + (44.9 - 6.55\log h_{te})\log d$
__For medium sized city__
$a(h_{re}) = (1.1\log f_c - 0.7)h_{re} - (1.56\log f_c - 0.8)$ dB
__For large city__
$a(h_{re}) = 8.29(\log 1.54 h_{re})^2 - 1.1$ dB for $f_c \leq 300$ MHz
$a(h_{re}) = 3.2(\log 11.75 h_{re})^2 - 4.97$ dB for $f_c \geq 300$ MHz
L_{50} *(Suburban)* (dB) = L_{50} *(urban)* $- 2[\log(f_c/28)]^2 - 5.4$
L_{50} *(rural)* (dB) = L_{50} *(urban)* $- 4.78(\log f_c)^2 + 18.33\log f_c - 40.94$

1. a) Compare various generations of mobile communications up to the fourth generation. [4]
   b) What are various practical handoff considerations? Explain. [4]

2. Determine: [6]

   a) the cell cluster size
   b) the number of cell clusters in the service area
   c) the maximum number of users in service area at any instant

3. a) Discuss what is meant by the term FADING. Describe briefly its types in radio propagation. [2+2]

   b) Let us consider a medium sized city and assume the typical GSM downlink parameters. The Base Station (BS) is transmitting with power 50W. The minimum acceptable received power at Mobile Station (MS) is -91 dBm. The carrier frequency is 900 MHz, the height of BS is 30m and height of MS is 1m. Estimate the maximum cell radius and corresponding cell area using Hata Model. (*The expression below should be provided in the question) [6]

4. a) Describe Direct Sequence and Frequency Hopped Spread Spectrum Techniques. [4]

   b) State the advantages and disadvantages (two of each): [4]

   (i) Frequency Division Multiple Access (FDMA)
   (ii) Time Division Multiple Access (TDMA)
   (iii)Code Division Multiple Access (CDMA)

   c) Define the terms Coherence Bandwidth and Coherence Time explaining their significance in mobile radio propagation. [4]

5. a) Explain briefly adaptive equalization algorithms (any two) [4]
   b) Explain various space diversity techniques along with block diagrams. [4]

6. a) Describe Outdoor Propagation Models (any two) [5]
   b) Describe vocoders with block diagram. Briefly explain different kind of vocoders. [2+3]

7. a) Explain with necessary diagram system architecture of GSM. Mention functions of various Blocks in the architecture. [7]

   b) What is channelization code? Explain briefly forward channels in cdma IS-95. [4]

8. Write short notes: (Any three) [3×5]

   a) WiMAX
   b) Handover
   c) BPSK against QPSK modulation

Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Wireless Communication (EX751)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Differentiate between 2G and 3G with examples of appropriate technologies used. Explain the terms prioritized handoff and cell dragging. [4+2]

2. State the difference between large scale and small scale propagation model. Explain the different propagation mechanisms which have impact on propagation in mobile environment. [3+6]

3. A BS transmitter has a power output of 10 watts operating at a frequency of 250 MHz. The transmitter is connected by 20 m of an RF coaxial cable, which has a loss of 3-dB/100 m specification, to an antenna that has a gain of 9dBi. The receiving antenna is 25 km away and has a gain of 4 dBi. There is negligible loss in the receiver feeder line, but the receiver is mismatched; the receiving antenna and feeder cable are designed for 50 ohm impedance. The receiver impedance loss due to mismatch is of about 0.2 dB. Calculate the power delivered to the receiver, assuming free-space propagation. [8]

4. What do you understand by RACK receiver? Explain the working of a M branch RACK receiver. [8]

5. What are the different characteristics of speech signals? How they are used in designing of coders? [8]

6. What is self jamming problem in CDMA? Explain the operation of FHMA with the help of block diagram. Explain any two hybrid spread spectrum multiple access technique along with their advantage and disadvantage. [2+4+6]

7. Explain the working of all traffic and control channels used in GSM. [8]

8. Explain with block diagram the concept of Maximum Likelihood Sequence Estimation. Define time diversity. Explain two implementations of time diversity. [6+1+5]

9. Write short notes on: [3×3]
   a) WiMax
   b) LTE
   c) Viterbi decoding algorithm

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Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Wireless Communication (EX751)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Briefly describe the evolution of wireless communications from first to third generation.   [6]

2. A city with a coverage area of 1500 sq km is covered with a 12-cell system each with a radius of 1.387 km. If the total spectrum allocated is 28.5 MHz with a full duplex channel bandwidth of 25 MHz. Assume a GOS of 0.02 for a blocked calls cleared system, is specified and the offered traffic per user is 0.03 Erlangs and traffic intensity of each cell is 84 Erlang, compute: [12]

    (a) the number of cells in the service area

    (b) the number of channels per cell

    (c) the maximum carrier traffic

    (d) the total number of users that can be served for 2% GOS

    (e) the number of mobiles per unique channel.

    (f) Theoretical maximum number of users that could be served at one time by the system.

3. Explain the transmitter and receiver of DPSK modulation scheme. Briefly explain about pseudo-noise (PN) sequence. Why is it used?   [4+2+2]

4. What do you understand by frequency reuse concept? Define Co-channel reuse Ratio in details.   [6]

5. Explain the mobile radio propagation in terms of large scale path loss and small scale fading.   [8]

6. Explain the Transmission and Detection of QPSK modulation technique.   [8]

7. Why we need equalization technique in communication? Explain the basic equalization technique.   [2+5]

8. What are the characteristics of speech signal? Explain the operation of Linear predictive coder.   [2+6]

9. Explain the different types of spread spectrum multiple access techniques. Compare FDMA with CDMA.   [6+2]

10. What is small scale fading? Describe the different factor that influences the small scale fading.   [3+6]

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Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Wireless Communication (EX751)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt _All_ questions.
✓ The figures in the margin indicate _Full Marks_.
✓ Assume suitable data if necessary.

1. Discuss the evolution from 1G to 2G, 2.5G in the case of cellular network based on TDMA. [4]

2. Describe the techniques used for enhancing the capacity and coverage in cellular radio network. [8]

3. a) With appropriate expressions, distinguish between Rayleigh fading channel and Rician fading channel. [2]

   b) A wireless channel is characterized by the following power-delay profile: [6]

Power [dB]	0	-10	-20	-23
Delays [ns]	0	100	200	400

   Determine the root mean square (rms) delay spread and the 90% coherence bandwidth of the above channel. Is this channel flat fading or frequency selective fading for:

   i) An AMPS system with transmission bandwidth 30 kHz?
   ii) A GSM system with transmission bandwidth 200 kHz?

4. Explain any two outdoor propagation models used in mobile network environment. [3+3]

5. What are the parameters of mobile multipath channel? Explain. [7]

6. What is an OFDM? Generalize the modulation and demodulation technique of OFDM. [8]

7. a) Discuss and compare different types of antenna diversity technique. [4]

   b) Explain with block diagram the concept of Maximum Likelihood Sequence Estimation equalization. [4]

8. What is a channel coding? Explain types of linear predictive coder. [2+6]

9. a) Define near-far effect. Briefly describe any one hybrid spread spectrum multiple access technique which can mitigate the near-far problem. [2+2]

   b) What are the advantages of TDMA cellular system over FDMA cellular system? [4]

10. Explain the principle of FHMA. What do you mean by near-far effect in CDMA? How is it solved? Explain. [3+4]

11. What is GSM and CDMA standard? Explain the architecture of GSM. [4+4]

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INSTITUTE OF ENGINEERING
Examination Control Division
2071 Bhadra

Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Wireless Communication *(EX751)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ *Attempt All questions.*
✓ *The figures in the margin indicate **Full Marks**.*
✓ *Assume suitable data if necessary.*

1. Explain the evolution of cellular radio 1G to 3G. [4]

2. Prove that for a hexagonal geometry the co-channel reuse ratio is given by $Q = \sqrt{3N}$; Where $N = i^2 + j^2 + ij$. A cellular service provider decides to use a digital TDMA scheme which can tolerate a Signal-to-Interference Ratio of 15 dB in the worst case. Find the optimal value of N for [4+4]

   a) Omni directional antennas
   b) 120° Sectoring
   c) 60° Sectoring

   [Use path loss exponent of 4 and consider trunking efficiency]

3. Derive the expression for phase difference in two ray free space propagation model. [8]

4. A mobile is located 5 km away from a base station and a vertical $\lambda/4$ monopole antenna with a gain of 2.55 dB to receive cellular radio signals. The electric field at 1 km from the transmitter is measured to be 10^{-3} V/m. The carrier frequency used for this system is 900 MHz. [6]

   a) Find the length and effective aperture of the receiving antenna.
   b) Find the received power at the mobile using two ray ground reflection model assuming the height of the transmitting antenna is 50 m and the receiving antenna is 1.5 m above ground.

5. What is the difference between path loss and fading of signal? Explain time dispersion fading and its types. [2+6]

6. Explain the transmitter and receiver of OQPSK modulation. Discuss why $\pi/4$-QPSK is more preferred than OQPSK modulation. [5+2]

7. Why diversity is important in wireless communication system? Explain different types of diversity techniques. [2+6]

8. Explain the operation of formant vocoder. What are the characteristics of speech signal? [4+4]

9. Explain the terms Multiple access, Time Division CDMA (TCDMA) and Time Division Frequency Hopping as related to wireless communication system. [7]

10. What is a multiple access technique? Explain TDMA, CDMA and SDMA. [2+6]

11. What are the basic signal processing operations to be performed to convert a speech signal into a radio signal and back in GSM? Describe briefly. [8]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Magh

Exam.			
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Wireless Communication (EX751)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt All questions.
✓ The figures in the margin indicate Full Marks.
✓ Assume suitable data if necessary.

1. Explain the evolution of wireless communication in terms of technology and worldwide market penetration. [6]

2. What is hand off? Explain its strategy used in GSM. [8]

3. Determine the propagation path loss for signal at 800 MHZ, with a transmitting antenna height of 30 m and a receiving antenna height of 2 m, over a distance of 10 km, using two-ray mobile point-to-point propagation model. How is it compared with that of free-space propagation path loss model? [4+4]

4. Define Doppler spread. Describe the types of small scale fading based on Doppler spread. Calculate the mean excess delay and rms delay spread for the multipath profile given below. Estimate the 90% and 50% coherence bandwidth of the channel. [4+4]
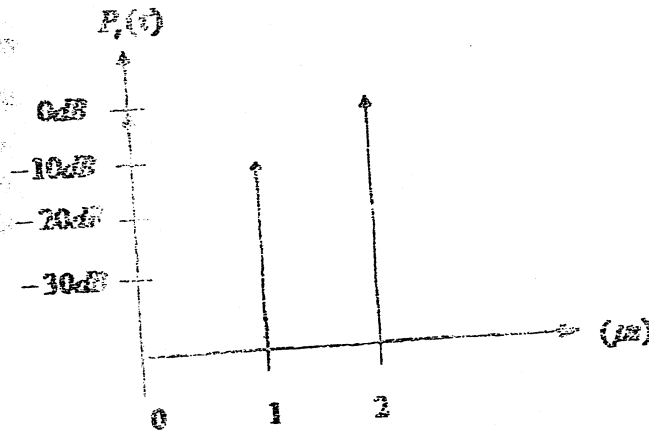
5. What are MSK and GMSK modulation techniques? Draw the block diagram of OFDM modulator and demodulator and explain them. [8]

6. Describe the fundamentals of equalization with respect to communication system? Explain with block diagram the function of Rake receiver. [4+4]

7. Why we need speech coding techniques? Explain the basic concept of VOCODER. [4+4]

8. What is multiple Access technique? Compare FDMA with CDMA. [2+4]

9. Draw the architecture of GSM and explain it. [8]

10. Write short notes on: [4×3]
   a) Rayleigh and Ricean fading distribution
   b) Regulatory issues in wireless systems
   c) Viterbi decoding algorithm

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Wireless Communication (EX751)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt All questions.
✓ The figures in the margin indicate Full Marks.
✓ Assume suitable data if necessary.

1. List the significant improvements introduced in the second, third and beyond third generation standards of cellular communication systems.   [6]

2. Explain the difference between co-channel and adjacent channel interference. Prove that the co-channel reuse ratio is given by $Q = \sqrt{3N}$, where $N = i^2 + ij + j^2$ is the cluster size. If 20 MHz of total spectrum is allocated for a duplex (i.e. bidirectional) wireless cellular system and each simplex (i.e. one-way) channel has 25 KHz of bandwidth, find   [3+4+3]

   a) The number of duplex channels, and
   b) The total number of channels per cell, assuming a cluster size of $N = 4$.

3. Explain indoor propagation models (any two).   [8]

4. Determine the radio coverage range of a base station that transmits a RF signal at 150 W, given the receiver threshold level is −104 dBm. Assume that the path loss at the first meter is 15 dB in a mobile radio propagation condition. (Path loss exponent = 4)   [6]

5. Discuss the principle of Orthogonal Frequency Division Multiplexing modulation scheme. Briefly explain different types of spread spectrum modulation techniques.   [4+4]

6. What is diversity? Explain any two types of diversity techniques in detail.   [2+6]

7. What is vocoder? Explain any two predictive coders.   [2+6]

8. Define multiple access. What are the merits and demerits of Code Division Multiple Access? If a normal GSM time slot consists of 6 trailing bits, 8.25 guard bits, 26 training bits, and 2 traffic bursts of 58 bits of data, find the frame efficiency.   [2+6+4]

9. Draw and explain the frame structure for GSM. Describe how various traffic and control channels are used while making a call in GSM system.   [4+4]

10. Write short notes on: (any two)   [6]

    a) Viterbi Decoding Algorithm
    b) Doppler Spread and Coherence Time
    c) GMSK Modulation Technique

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Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Advanced Wireless and Mobile Communications *(Elective II)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ *Attempt any __Ten__ questions.*
✓ *__All__ questions carry equal marks.*
✓ *Assume suitable data if necessary.*

1. Why propagation model is needed for mobile communications? Let us consider a Kathmandu city with following different GSM downlink parameters, BS is transmitting with power 40W, received power at the cell boundary is -98 dBm, carrier frequency is 900MHz, the height of base station is 30m and height of mobile station is 1m. Estimate the maximum cell radius and corresponding cell area.

    {Hints: The Hata model for typical path loss for urban area is given as $L_u=69.55+26.16 \log(f)-13.82 \log (h_B)-a(h_M)+[44.9-6.55 \log (h_B)] \log(d)$ and where $a(h_M)$ for small and medium sized cities can be found in dB as $a(h_M)=[1.1 \log(f)-0.7]h_M-1.56 \log(f)+0.8$ and for large cities depending upon frequency as $a(h_M)=8.29[\log(1.54 h_M)]^2-1.10$; when $f \leq 200$ MHz and $a(h_M)=3.2[\log(11.75 h_M)]^2-4.97$, when $f \geq 400$ MHz}

2. What are the major limitations of GSM? Draw and briefly explain the basic architecture of GPRS.

3. What are the major differences between GSM and WCDMA? Explain major features of WCDMA.

4. What is a diversity technique? What are the major advantages of MIMO technique over SISO technique? Explain MIMO mode of operation.

5. What are the major advantages of multicarrier modulation over single carrier modulation? Explain briefly about OFDMA system.

6. What are the basic driving forces for 3G evolution? Explain briefly the cellular network evolution trends.

7. Draw the basic architecture of LTE/SAE network architecture. Explain briefly.

8. Draw the basic architecture of IEEE 802.11 infrastructure based network. Explain IEEE 802.11 layers and functions.

9. What is ad-hoc network? Write down the major applications of ad-hoc networks. What are the major challenges for ad-hoc network routing? Explain.

10. What are strengths of WiMax over WiFi? Explain the physical and MAC layer features of WiMax.

11. What is heterogeneous network? Explain next generation all-IP network.

12. What is TCP/IP protocol? Explain IPv4 subnet mask and sub-netting with an example.

13. What is MPLS protocol? Draw and explain the basic architecture of VOIP.

14. Write Short notes (any two):
    a. LTE-Advance key features
    b. SIP and RTP
    c. UTRAN

Examination Control Division
2067 Ashadh

Exam.		Regular/Back	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Wireless Communication (Elective I)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Explain how cell splitting and sectoring improve coverage and capacity in Cellular System [8]

2. (a) Deduce the expression:

$$\frac{D}{R} = \sqrt{3N}$$

(Symbols have their usual meaning). [4]

(b) What is blocking probability? Discuss the effect of Trunking and GOS in cellular network? [4]

3. (a) in a country GSM 900MHz radio signal suffer mean path loss of 155dB in its cellular network with average base station antenna height of 30m. Calculate number of base stations required for carpet coverage. [Area of country 50,000 Sq Km, a(hre) = 5dB]
(b) For 7-cell 3-sector cell plan calculate worst case SIR on downlink channels for first tier. [n=4]
(c) if the country has population of 4 million and the operator has a penetration of 10% then calculate number of ARFCN required per sector to serve its subscribers.[Au = 35mErl] [6+2+2]

4. (a) Explain Co-channel and Adjacent channel interference and their effect on system capacity? [4]
(b) Contrast log distance and log normal path loss models? [4]

5. Define Diversity in wireless communication. Explain space diversity reception methods. [8]

6. Describe signaling system No.7 (SS7). Illustrate with OSI comparison [10]

7. Draw GSM system architecture, describe components and explain mobile originated call scenario? [10]

8. DECT is FDMA/TDMA/FDD radio transmission technology. Justify the statement with illustrations. [10]

9. Write short note on (Any two): [4x2]
   (a) Raised cosine roll off filter.
   (b) Spread spectrum modulation.
   (c) Interleaving

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Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Advanced Wireless & Mobile Communications *(EG785EX) (Elective II)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt _All_ questions.
✓ _All_ questions carry equal marks.
✓ Assume suitable data if necessary.

1. What are the key features of GPRS? Explain GPRS architecture.

2. What is near far problem? Explain power control algorithm in WCDMA.

3. Capacity of MIMO channel is higher than SISO channel. Explain it.

4. Why multicarrier modulation is necessary? Explain basic principle of OFDMA.

5. What are the key features of LTE? Explain LTE network elements.

6. What are the design goals of wireless LAN? Explain IEEE 802.11 architecture.

7. Explain the different features of WiMax.

8. What is heterogonous network? Explain the basic features of NGN.

9. What are the different classes of IP address? Explain the concept of sub-netting with an example.

10. Write short notes (Any two)

   a. IPV6

   b. Power link budget analysis

   c. IMT-Advanced

***

Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Advanced Wireless & Mobile Communications (EG785EX) (Elective II)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt All questions.
✓ All questions carry equal marks.
✓ Assume suitable data if necessary.

1. What are the key features of GPRS? Explain GPRS architecture.

2. What is near far problem? Explain power control algorithm in WCDMA.

3. Capacity of MIMO channel is higher than SISO channel. Explain it.

4. Why multicarrier modulation is necessary? Explain basic principle of OFDMA.

5. What are the key features of LTE? Explain LTE network elements.

6. What are the design goals of wireless LAN? Explain IEEE 802.11 architecture.

7. Explain the different features of WiMax.

8. What is heterogonous network? Explain the basic features of NGN.

9. What are the different classes of IP address? Explain the concept of sub-netting with an example.

10. Write short notes (Any two)

    a. IPV6

    b. Power link budget analysis

    c. IMT-Advanced

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Bhadra

Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEI	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Artificial Intelligence (CT 710)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ Assume suitable data if necessary.

1. What is Turing test? How is can be used to measure intelligence of machine? Explain. [2+5]

2. What are the steps of Problem solving? Assume you are given three empty jugs; a 3 – gallon, a 5-gallon and a 9-gallon, and a pump can fill water only in 3- gallon jug. How you get exactly 7 gallons of water in the 9- gallon jug? Formalize the problems; write down production rules and draw search tree to solve this water Jug problem. [2+1+2+3]

3. Different between Depth first search and Breadth first search with their performance criteria. [7]

4. Prove that "Charlie is a mammal" with given propositions. [8]

    a) Cows, pigs and horses are mammal
    b) The child of horse is a horse
    c) Bluebeard is a horse
    d) Bluebeard is charlie's father
    e) Child and father are inverse relation
    f) Every mammal has a father

5. Differentiate between forward chaining and backward chaining using suitable example. [7]

6. List the issues need to be consider in Knowledge Representation techniques. Convert given sentences into Semantic Network. [2+6]
    a) Tom is a cat
    b) Tom fights with rat
    c) Tom is owned by Ram
    d) Tom is black in color.
    e) Cats like milk
    f) Rats like cheese
    g) The cat sat on the bed
    h) A cat is a mammal
    i) A Rat is an animal
    j) All mammals are animals
    k) Every mammal gives birth a baby

7. What do you mean by membership of an element in a fuzzy set? Explain the steps involved in Fuzzy Learning with suitable example. [2+6]

8. Define Artificial Neural Network. How non-linearity can be modelled through this ANN? Explain with example. [1+7]

9. List down the challenges faced by NLP. Why do you think machine vision is important in AI? Explain with example. [2+5]

10. Write short notes on: [3×4]

    a) Hill climbing algorithm
    b) SOM
    c) Expert system

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Baishakh

Exam.		Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Artificial Intelligence (CT 653)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. List down disadvantages of AI? What is the importance of the Turing Test in Artificial Intelligence? What are the applications of AI? Explain. [2+2+4]

2. What do you understand by Constraint satisfaction problem? Solve the given Crypt-arithmetic problem: [2+6]

```
    T  E  N
    T  E  N
+ F  O  R  T  Y
. S  I  X  T  Y
```
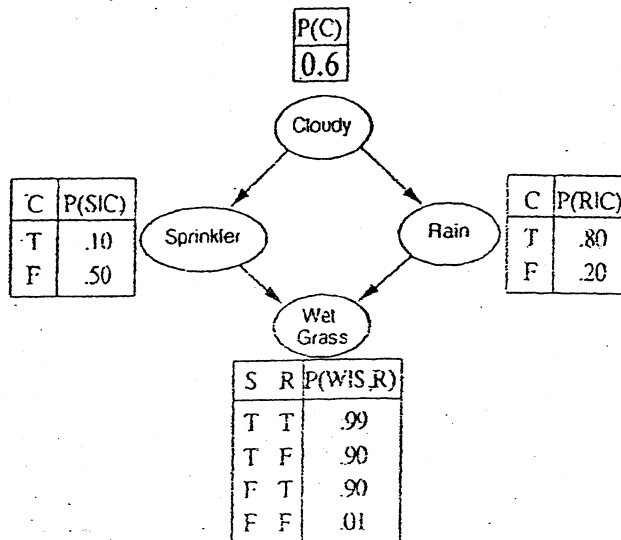
3. Explain A* search method using a suitable example. Discuss the drawbacks of Hill Climbing Algorithm. [6+2]

4. Assume the following facts:
   (i) Cow, Buffalo, Bull are mammals.
   (ii) An offspring of a Cow is Cow.
   (iii)Kali is a Cow.
   (iv)Kali is Taarey's parent.
   (v) Offspring and parent are inverse relations.
   (vi)Every mammel has a parent.
   By using resolution refutation method, prove that Taarey is a Cow. [8]

5. What do you understand by Bayesian Network? For the given Bayesian network below, find the probability of grass being wet when the weather is cloudy, there is some sprinkler but no rain i.e. C = True, S = True, R = False and W = True. [2+6]

P(C)
0.6

Cloudy

C	P(S|C)
T	.10
F	.50

Sprinkler

Rain

C	P(R|C)
T	.80
F	.20

Wet Grass

S	R	P(W|S,R)
T	T	.99
T	F	.90
F	T	.90
F	F	.01

6. Differentiate between frames and semantic nets with an example. Why semantics nets and frames are important in AI? [6+2]

7. What is Machine Learning? Explain learning framework with suitable block diagram. [2+6]

8. What is perception? Construct a Hebbian network that performs like an AND gate. [1+7]

9. Explain the ambiguity in NLP. Discuss the different steps involved during NLP. [2+6]

10. Write short notes on: [2×4]
    a) Supervised vs Unsupervised Learning
    b) Min max algorithm

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2077 Chaitra

Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Artificial Intelligence (CT 653)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Define Artificial Intelligence (AI). When is a machine said to have passed the Turing Test? Discuss two fields of application of AI. [2+3+3]

2. What do you understand by Production system problem? Solve the following crypto arithmetic problem. [2+6]

   WRONG + WRONG = RIGHT

3. List out the disadvantages of MIN-MAX algorithm for Game playing and explain how Alpha-beta pruning helps to overcome the limitation of MIN-MAX algorithm with an example. [2+6]

4. It is a crime for an American to sell weapons to hostile nations. Nono has some missiles. All the missiles owned by Nono were sold to it by Colonel West. Missiles are weapons. An enemy of America counts as hostile. Colonel West is an American. The country Nono, is an enemy of America. Prove that Colonel West is a criminal by using FOPL based Resolution Refutation Method. [8]

5. What is rule-based reasoning? Explain with an example. How Bayes theorem wedin belief network? [2+6]

6. What do you mean by Conceptual Dependency? Explain how knowledge is represented using scripts. [3+5]

7. Explain all the steps in the genetic algorithm with block diagram and operators. [8]

8. What is neural network? Show that a single neuron cannot implement XOR gate. [2+6]

9. Draw the block diagram of an expert system and briefly explain each component. List the benefits of using expert system? [6+2]

10. Write short notes on: [2×4]

    a) Hill climbing problems
    b) Fuzzy learning

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Baisakh

Exam.		Back	
Level	BE	Full Marks	8 0
Programme	BCT	Pass Marks	3 2
Year / Part	III / II	Time	3 hrs.

Subject: - Artificial Intelligence (CT 653)
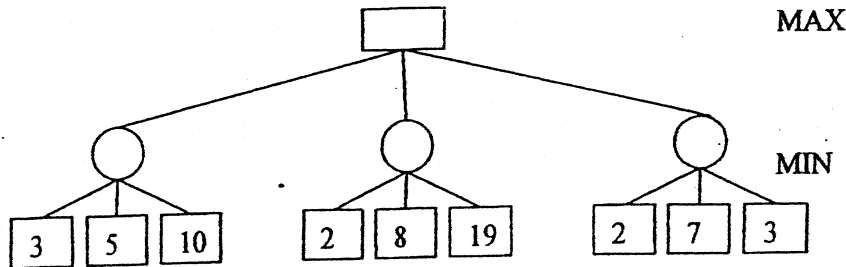
✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt All questions.
✓ The figures in the margin indicate Full Marks.
✓ Assume suitable data if necessary.

1. Define Artificial Intelligence. Justify that "system that think rationally and act rationally." is part of Artificial Intelligence. [8]

2. Solve following crypto-arithmetic problem.

   SEND+MORE=MONEY.

   Assign different decimal digit to different letters. Explain the steps followed for the solution. [8]

3. Discuss about alpha-beta purning algorithm. Find the value of min max value using this concept in the following tree. [4+4]

4. List down the rule for Inference. Consider the following axioms.
   All hounds howl at night.
   Anyone who has any cats will not have any mice.
   Light sleepers do not have anything which howls at night.
   John has either a cat or a hound.
   Prove: "If John is a light sleeper, then John does not have any mice." By using resolution refutation. [2+8]

5. Define a semantic network and frames with an example. List advantages and limitations of both. [6+2]

6. What is machine learning? Explain learning by analogy with example. [2+6]

7. What is McCulloch/Pitts neuron? Can this neuron be trained, to represent EX-OR gate? It Justify and propose neural network model. [10]

8. What is an expert system? Explain the components of an expert system. [1+7]

9. Write short notes on: [3x4]

   a) Boltzman Machine
   b) Conjuctive Normal Form
   c) A* Algorithm

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Subject: - Artificial Intelligence (CT 653)

1. Define Artificial Intelligence. Describes four views of Artificial Intelligence in details. [6]

2. What is well defined problem? You are given two jugs, a 5-gallon one and a 7-gallon one, a pump which has unlimited water which you can use to fill the jug, and the ground on which water may be poured. Neither jug has any measuring markings on it. How can you get exactly 4 gallons of water in the 1-gallon jug? Solve the problem using production system. [2+6]

3. Distinguish between Breadth First Search and Depth First Search. Write algorithm for Min Max algorithm with appropriate example of your own. [4+4]

4. Assume following facts: [3+5]
   a) Dinesh likes all kinds of food.
   b) Samosa's are food.
   c) Cake is food.
   d) Anything anyone eats and isn't killed by is food.
   e) Suresh eats peanuts and still alive.
   f) Aashu eats everything suresh eats.
   First write all the clauses into predicates, then using resolution refutation method, prove that Dinesh likes peanuts.

5. In a village 1% of people have a certain genetic defect. 90% of test for gene defected people detect the defect. 9.6% of the test detect the positive result even if the person has no gene defect. If a person gets a positive test result, what are the odds they actually have the genetic defect? [4]

6. What are the issues in knowledge representation? Represent the following sentences into a semantic network: [2+4]
   Circus elephants are elephants
   Elephants have head.
   Elephants have trunks.
   Heads have mouths.
   Elephants are animals.
   Animals have hearts.
   Circus elephants are performers.
   Performers have costumes.
   Costumes are cloths.
   Horatio is a circus elephant.

7. What do you mean by label data? Use ID3 method for following data to draw decision tree diagram. [2+8]

AGE	COMPETITION	TYPE	PROFIT
OLD	YES	SOFTWARE	DOWN
OLD	NO	SOFTWARE	DOWN
OLD	NO	HARDWARE	DOWN
MID	YES	SOFTWARE	DOWN
MID	YES	HARDWARE	DOWN
MID	NO	HARDWARE	UP
MID	NO	SOFTWARE	UP
NEW	YES	SOFTWARE	UP
NEW	NO	HARDWARE	UP
NEW	NO	SOFTWARE	UP

8. Differentiate the followings: [5×2]

   a) Rule based learning versus Fuzzy learning
   b) Expert System versus Management Information System

9. Explain two practical example of Natural Language Processing in real life. Explain all the steps of Natural Language Processing in details. [3+5]

10. Write short notes on the followings: [4×3]

   a) Min-max search
   b) Skolemization
   c) Virtual reality

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Examination Control Division
2076 Baisakh

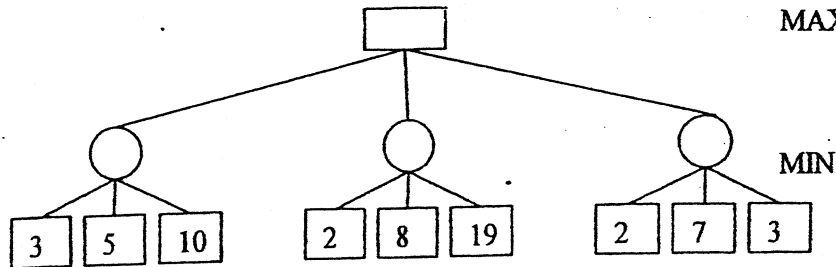| Exam.		Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Artificial Intelligence *(CT 653)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Define Artificial Intelligence. Justify that "system that think rationally and act rationally." is part of Artificial Intelligence. [8]

2. Solve following crypto-arithmetic problem.

SEND+MORE=MONEY.

Assign different decimal digit to different letters. Explain the steps followed for the solution. [8]

3. Discuss about alpha-beta purning algorithm. Find the value of min max value using this concept in the following tree. [4+4]

4. List down the rule for Inference. Consider the following axioms.
   All hounds howl at night.
   Anyone who has any cats will not have any mice.
   Light sleepers do not have anything which howls at night.
   John has either a cat or a hound.
   Prove: "If John is a light sleeper, then John does not have any mice." By using resolution refutation. [2+8]

5. Define a semantic network and frames with an example. List advantages and limitations of both. [6+2]

6. What is machine learning? Explain learning by analogy with example. [2+6]

7. What is McCulloch/Pitts neuron? Can this neuron be trained, to represent EX-OR gate? It Justify and propose neural network model. [10]

8. What is an expert system? Explain the components of an expert system. [1+7]

9. Write short notes on: [3x4]

   a) Boltzman Machine
   b) Conjuctive Normal Form
   c) A* Algorithm

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Artificial Intelligence (CT653)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt All questions.
✓ The figures in the margin indicate Full Marks.
✓ Assume suitable data if necessary.

1. What is an intelligent agent? How does learning agent work? [8]

2. What do you understand about well defined problems? Explain about problems that can be solved using production rules with an example. [2+6]

3. Discuss about the evaluation criteria for search algorithm. State the problems in hill climbing search algorithm. [4+4]

4. Why CNF is necessary? "Everyone who loves all animals are loved by someone" represent this statement in FOPL and explain all the steps involved to convert it into CFN. [2+6]

5. What is knowledge representation? How semantic network is used to represent knowledge? [2+6]

6. What do you understand by swarm intelligence? Suppose chromosomes are of the form x = a b c d e f g h with a fixed length of eight genes. Each gene can be any digit between 0 and 9. Let the fitness of individual x be calculated as: [2+8]

   $f(x) = (a+b) - (c+d) + (e+f) - (g+h)$ and let the initial population consist of four individuals with the following chromosomes.

7. What is Natural Language Processing (NLP)? Discuss the different steps in NLP with suitable examples. Also list down major issues in NLP. [6+2+2]

8. Explain Hopfield network with an example. [8]

9. Write short notes on: [3×4]
   i) Predicate logic
   ii) Unsupervised learning
   iii) Breadth first vs depth first search

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INSTITUTE OF ENGINEERING

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2075 Baisakh

Exam.		Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Artificial Intelligence (CT653)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Define AI. What is the importance of Turning Test in AI? List applications of AI.   [2+4+2]

2. What is problem space? Solve the following crypto arithmetic problem by showing all the steps.   [2+6]
   BASE + BALL = GAMES

3. Discuss the hill climbing search algorithm along with problem associated with it and discuss their solutions. Why simulated annealing is important?   [6+2]

4. Given premises "Every American who sells weapons to hostile nations is a criminal. The country XYZ is enemy of America. All of its misallies in XYZ were sold by Donald, who is an American." Prove that Donald is a criminal by using FOPL based resolution refutation method.   [8]

5. Why CNF is required? Explain all the steps used to convert a quantified statement with suitable example.   [2+6]

6. Why semantic network and frames are important in AI? Provide examples of both with FOPL statements example.   [2+6]

7. What is a genetic algorithm? Explain all steps in genetic algorithm with block diagram and operators.   [8]

8. List the importance of expert system in real life. Draw block diagram of expert system architecture and explain all blocks.   [2+6]

9. What is a McCulloch/Pitts neural network? Explain it with reference to AND gate. Justify that it cannot be applied to Exclusive OR gate.   [8]

10. Justify that NLP is one of the important part of an AI. Explain the steps involved in the NLP.   [8]

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Exam		Regular	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Artificial Intelligence (CT653)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. What is a rational agent? "System that think like humans" and "System that act like humans" are the part of artificial intelligence. Justify these statement with practical example. [1+6]

2. Define constraint satisfaction problem (CSP). Solve the following crypto-arithmetic problem, where different letters denote different integers and identical letters denote same integer. SWIM + WEAR = RELAX. [1+6]

3. Why Searching is important in problem solving? What do the drawbacks of greedy best-first search and how A* search algorithm solve it. Explain with an example. [2+7]

4. a) Assume the following facts: [8]

   - John likes all kinds of food.
   - Apples are food.
   - Chicken is food.
   - Anything anyone eats and isn't killed by is food.
   - Bill eats peanuts and is still alive.
   - Sue eats everything bill eats.

   Prove that John likes peanuts using resolution.

   b) Differentiate between forward and backward chaining. [4]

5. What is Frame? How is it different from semantic net in knowledge representation? [7]

6. Define inductive Learning. Explain in detail about ID3 process with suitable example. [2+6]

7. What is self-organizing Map (SOM)? Explain all the steps involved in SOM with suitable example. [2+5]

8. Justify that the study of gene is one of important part in the AI. List down the steps involved in genetic algorithm with an example. [4+4]

9. How knowledge acquisition is performed in expert system? Explain one real expert system example with proper architecture. [2+5]

10. Write short notes on: (Any two) [2×4]

    a) Machine Vision
    b) Supervised Vs Unsupervised learning
    c) Back Propagation Algorithm

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Examination Control Division
2073 Bhadra

Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: – Artificial Intelligence (CT653)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. If the Turing Test is passed, does this show that computers exhibit intelligence? State your reasons. [7]

2. Solve the following puzzle by assigning numeral (0-9) in such a way that each letter is assigned unique digit which satisfy the following addition. [7]

   ONE + ONE + TWO = FOUR

3. Explain the necessity of searching techniques in AI? Differentiate between Breath first search and Depth first search with their performance criteria. [4+5]

4. Assume the following facts: [8]

   i) Horses, cows, pigs are mammals
   ii) An offspring of a horse is a horse
   iii) Bluebeard is a horse
   iv) Bluebeard is Charlie's parent
   v) Offspring and parent are inverse relations
   vi) Every mammal has a parent

   Prove Charlie is a horse using resolution refutation.

5. What is causal net? How does Bayes Theorem calculate the probability in a causal net? Explain with example calculation. [7]

6. Convert given sentences into Semantic Network. [7]

   i) The height of the adult male is 5.10
   ii) Baseball player is an adult male.
   iii) Adult male is a person.
   iv) Batting average of Baseball players is 0.252
   v) Pee-wee-Reese is a Fielder.
   vi) Fielder is Baseball player.
   vii) Team of pee-wee-Reese is Brooklyn Dodger.

7. "Learning is an essential characteristic for intelligent agents." List down justification on this statement. Write about the role learning with suitable example. [4+4]

8. What are applications of Expert System? Describe the Development stages of Expert System briefly. [2+6]

9. Define a NLU and a NLG. List down the different steps involved in the natural language processing (NLP) with suitable examples. [2+7]

10. Define Hebbian learning. Use Hebbian learning algorithm to Construct Hebbian Network which perform line AND Function. [3+7]

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Examination Control Division

2073 Magh

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Artificial Intelligence (CT653)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Define Artificial Intelligence (AI). Describe the importance and practical application of AI. [6]

2. A farmer has a goat, a wolf and a cabbage on the west side of a river. He wants to get all of his animals and his cabbage across the river onto the east side. The farmer has a row boat but he only has enough room for himself and one other thing. The wolf will eat the goat if they are left together alone. The goat will eat the cabbage if they are left together alone. How can the farmer get everything on the east side? [8]

   i) Formulate this puzzle as search
   ii) Solve this problem-using search (any method)
   Draw the search tree and show the final solution

3. Devise an example to show how A* algorithm uses path cost and heuristic cost to generate best solution. [8]

4. Consider the following axioms: [10]

   i) Anyone whom Mary loves is a football star
   ii) Any student who does not pass does not play
   iii) John is a student
   iv) Any student who does not study does not pass
   v) Anyone who does not play is not a football star.

   Prove that "If John does not study, then Mary does not love John" Resolution by Refutation.

5. A doctor is called to see a sick child. The doctor has prior information that 90% of sick children in that neighborhood have the flu, while the other 10% are sick with measles. Let F stand for an event of a child being sick with Flu and M stand for an event of a child being sick with measles. Assume for simplicity that there no other maladies in that neighborhood. A well-known (and common) symptom of measles is a rash and has probability of 0.95. [8]

   However, very occasionally, children with flu also develop rash and has probability of 0.08.

   Upon examining the child, the doctor finds a rash. What is the probability that the child has measles?

6. Explain Frames and Semantic Net with examples. List down their advantages and limitations. [4+4]

7. What is Fuzzy Logic and why is it important? Explain about Mamdani Fuzzy Inference Method with example. [3+7]

8. What do you understand by Perception? How can we design a neural network that acts as an XOR gate? [1+7]

9. Differentiate between declarative knowledge and procedural knowledge. Describe expert system with its architecture and practical uses. [3+5]

10. What s Natural Language processing? Explain the different steps in the natural language processing. [2+4]

Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Artificial Intelligence (CT653)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt All questions.
✓ The figures in the margin indicate Full Marks.
✓ Assume suitable data if necessary.

1. What is an Artificial Intelligence (AI)? Explain any two applications of AI in real field. [7]

2. What do you understand by Constraint satisfaction problem? Solve the following Crypt-arithmetic problem. [1+6]

       SEND
     + MORE
      MONEY

3. What is a searching? Explain Breadth First Search and Depth First Search and compare their performance criteria. [9]

4. What is a knowledge, representation and reasoning? Describe forward chaining with practical example. [2+5]

5. Assume the following facts: [7]
   - John likes all kinds of food.
   - Apples are food.
   - Chicken is food.
   - Anything anyone eats and isn't killed by is food.
   - Bill eats peanuts and is still alive.
   - Sue eats everything Bill eats.

   Prove that John likes peanuts using resolution refutation

6. What are semantic nets and frames? How frames are useful in semantic nets. [7]

7. What is a machine learning? Explain in detail about Boltzmann machines with suitable algorithm and explanations. [2+8]

8. What is a neural network? Explain the back propagation algorithms and perceptron. [2+4+4]

9. What is an expert system? Explain its advantages and disadvantages. [8]

10. What is a Natural Language Processing? Describe Natural Language Processing Steps and its application. [2+6]

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Subject: - Artificial Intelligence (CT653)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ Assume suitable data if necessary.

1. If the Turing Test is passed, does this show that computers exhibit intelligence? State your reasons. [7]

2. What is a Constraint satisfaction problem? Solve the following crypto-arithmetic problem with necessary steps:

    LOGIC+LOGIC=PROLOG. [3+4]

3. Searching is an important part of AI, justify it. Explain any two types of blind search and compare them in terms of space and time complexity. [2+7]

4. What is a rule based reasoning? Explain Backward Chaining with suitable example. [7]

5. Using resolution solve the following statements: [7]

    All pompeian are Romans. All Romans were either loyal to Caesor or hated him. Everyone is loyal to someone. People only try to assassinate rulers they not loyal to. Marcus tried to assassinate Caesor. Marcus was pompeian. Find, did Marcus Caesor?

6. What are Frames and Semantic Net? Convert the given sentences in semantic Net. [7]

    i)   A person is a mammal.
    ii) Sakti Gauchan is a person.
    iii) Person has nose.
    iv) Sakti Gauchan is in Nepalese team.
    v)   Uniform color of sakti Gauchan is Red/Blue.

7. What is a machine learning? Explain genetic algorithm (GA) along with GA operators. List some of areas where GA can be applied. [2+6+2]

8. What do you understand by a perceptron? How can we design a neural network that acts as an OR gate. [2+7]

9. Differentiate between declarative knowledge and procedural knowledge. Describe expert system with its architecture and practical uses. [3+6]

10. Explain different steps involved in the natural language processing (NIP) with suitable block diagram and examples. [8]

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Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Artificial Intelligence (CT653)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. What is Artificial Intelligence (AI)? Discuss history of AI in brief. [2+5]

2. What is the advantage of depth limit search? Compare it with other search strategies. [4+4]

3. If X is on the top of Y, Y supports X. If X is above Y and they are touching each other, X is on the top of Y. A cup is above a book. A cup is touching a book. Show that supports (book, cup) is true. [8]

4. Give an example of learning by analogy. How knowledge can be represented using semantic network? Explain with suitable example. [1+7]

5. Explain Backward Chaining with suitable example. [7]

6. What is conceptual dependency? Explain some of common primitives used in conceptual dependency. [2+5]

7. What makes a problem "Well Defined"? Explain with a sample example of a state-space search framework. [3+4]

8. What is Artificial Neural Network (ANN)? Compare ANN with human brain with its functioning principle. [3+5]

9. Define knowledge acquisition with example. Explain the architecture of expert system. [2+6]

10. Compare the following: [4×3]

    a) Declarative versus Procedural Knowledge
    b) Pragmatic versus Phonetic Analysis
    c) Genetic algorithm based versus Fuzzy based learning

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Subject: - Artificial Intelligence (CT653)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt All questions.
✓ The figures in the margin indicate Full Marks.
✓ Assume suitable data if necessary.

1. Distinguish between knowledge and learning. What does acting humanly refer to? Explain. Define well defined problems. [2+5+1]

2. Solve the following cryptoarithmetic problem with necessary steps. [7]
   ONE + ONE + TWO = FOUR

3. How informed search is different from uniformed search? Explain min-max algorithm with suitable example, also discuss how alpha-beta is different from min-max algorithm. [2+4+3]

4. What is casual network? Explain reasoning in belief network with suitable example. [2+5]

5. What is neural network? Describe its types. A doctor knows that the disease meningitis causes the patient to have a stiff neck 50% of the time. The doctor also knows that the probability that a patient has meningitis is 1/50,000, and the probability that any patient has a stiff neck is 1/20. Find the probability that a patient with a stiff neck has meningitis? [3+5]

6. What is machine learning? Explain genetic algorithm along with different operators of genetic algorithm. [2+8]

7. What is Natural Language Processing (NLP)? Explain the syntactic, semantic and pragmatic analysis of NLP. [2+2+2+2]

8. Define expert system? Discuss about the general architecture of an expert system. [2+4]

9. How does machine vision help in Artificial Intelligence? Explain how back propagation algorithm helps in machine learning. [3+5]

10. Compare the followings: [3×3]

    a) Forward versus backward chaining
    b) Hopfield versus Kohonen network
    c) Analogy versus Inductive learning

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Exam.	New Back (2006 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Artificial Intelligence (CT653)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt All questions.
✓ The figures in the margin indicate Full Marks.
✓ Assume suitable data if necessary.

1. What is Artificial Intelligence (AI)? Discuss brief history of AI with Chronological development. [2+6]

2. Why searching is necessary in AI? Explain about the role of production system with suitable example. [2+6]

3. What is horn clause? Differentiate between Depth First Search and Breadth First Search. [1+7]

4. Explain backward chaining with suitable example and compare with forward chaining. [4+4]

5. Why do we need FOPL? State any three rules of inference. How can we make the machine with learning capacity? [2+3+3]

6. Define Boltzmann Machine. How knowledge can be represented using semantic network? Explain with suitable example. [1+7]

7. What is Machine Learning? What is Fuzzy Logic? Explain the Fuzzy Inference with suitable example. [2+6]

8. Differentiate declarative knowledge and procedural knowledge. Explain the architecture of expert system. [2+6]

9. What is the role of perceptron in neural network? Explain about bakpropagation algorithm. [3+5]

10. What is Natural Language Processing (NLP)? Discuss the different issues related with NLP with example. [2+6]

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Artificial Intelligence (CT653)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt _All_ questions.
✓ The figures in the margin indicate _Full Marks_.
✓ Assume suitable data if necessary.

1. Define AI. When a machine is said to be passed Turing test? Give any two examples of constraint satisfaction problem. [2+5+1]

2. Solve the following crypto-arithmetic problem, where different letters denote different integers and identical letters denote same integer. WRONG + WRONG = RIGHT. Explain the steps that you have followed. [5+3]

3. Differentiate between informed and blind search. How depth search is different to breadth first search. Compare with evaluation parameters. [4+4]

4. All oversmart persons are stupid. Children of oversmart presons are naughty. Ram is children of Hari. Hari is oversmart. Show that Ram is naughty. Using FOPL based resolution method. [8]

5. Explain the step involved in conjunctive normal form (CNF) with suitable example. [8]

6. What is semantic net? Explain with suitable example. [8]

7. What is machine vision? Discuss about the algorithm of Genetic Algorithm. [2+6]

8. What is neural network? Explain back-propagation algorithm learning. [4+4]

9. What is an Expert System? Explain the steps of an Expert System development. [4+4]

10. Define machine translation in NLP. Explain the challenges of machine translation. [1+7]

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Exam.		Old Back (2065 & Earlier Batch)	
Level	BE.	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Artificial Intelligence (EG743CT)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Define Artificial Intelligence (AI)? Justify that "AI makes machine working more human friendly". [8]

2. Define expert system. What are the building blocks of expert system? [8]

3. Compare the search strategy of breadth first search with depth first search. [8]

4. Convert the following sentences in to POPL and hence into CNF [8]

   i. Everyone likes someone.

   ii. All the students who visited science museum are not engineering student.

   iii. Sumit likes all fruits that are rich vitamin A.

   iv. Shyam likes all the movies that Krishna likes.

5. Explain learning framework with suitable example. [8]

6. What is backward chaining? Explain with suitable example. [8]

7. What are the different operators associated in genetic algorithm. [8]

8. Differentiate between supervised learning and unsupervised learning. [8]

9. Explain the different issues of Natural Language Processing (NLP). [8]

10. Explain different forms of knowledge modelling techniques. [8]

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Exam.	**Regular (2066 & Later Batch)**		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Artificial Intelligence (CT 653)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt _All_ questions.
✓ The figures in the margin indicate _Full Marks_.
✓ Assume suitable data if necessary.

1. Discuss any two fields of your daily life where artificial intelligence has been applied. (7)

2. Solve the following crypto-arithmetic problem, where different letters denote different integers and identical letters denote same integer. LOGIC + LOGIC = PROLOG
   Show all the step of solving through constraint satisfaction problem. (7)

3. Discuss the hill-climbing search algorithm along with problems associated with it and discuss their solutions. (9)

4. Given premises: Every American who sells weapons to hostile nations is a criminal. The country Abc is enemy of America. All of the missiles in Abc were sold by John. John is an American.
   Proof: John is a criminal. (10)

5. What are the different knowledge representation models? Discuss semantic nets with an example. (7)

6. What is Fuzzy learning? Explain with a practical example. (4)

7. Explain the learning framework with suitable example. (6)

8. What is a Hopfield Network? Explain all the steps involved in the Hopfield Network with suitable example. (8)

9. Explain different steps of expert system development with an example. (8)

10. What is a natural language processing? Explain it (6)

11. Write short notes: (any two) (4 x 2 = 8)
    i.   Skolemization
    ii.   Machine vision
    iii. Human Brain verses Neural Network

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2068 Chaitra

Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Artificial Intelligence

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt All questions.
✓ All questions carry equal marks.
✓ Assume suitable data if necessary.

1. Define and differentiate between "system that think like humans" and "system that act like humans". What are the ethical issues in the artificial intelligence?

2. How can you convert to conjunctive normal form? Explain all the steps with suitable examples.

3. "All married employees earning Rs. 225,000 or more per year in Nepal pay taxes. All unmarried employees earning Rs. 200,000 or more per year in Nepal pay taxes. The university professor of Nepal earns Rs. 400,000 and has to pay 25% taxes. No other employee earns more than the professor in the university. Some of Nepalese citizens earn less that Rs. 200 per day and they don't have to pay any taxes". Represent the above sentences in first-order logic and explain each step.

4. Draw the block diagram of the structure of an expert system and explain it. How can you represent expert system using if-then rules?

5. What is a depth first search? Explain it with required algorithm. How can you modify it to be an informed search?

6. Explain in detail about ID3 process with suitable example. Explain different factors involved in the learning.

7. What is a fuzzy logic and explain its importance? Explain the steps involved in the fuzzy logics.

8. What is a McCulloch/Pitts neural network? Explain it with reference to AND gate. Justify that McCulloch/Pitts neural network can't be applied to EX_OR gate.

9. Explain in detail about forward chaining with suitable example. What are the applications of forward chaining?

10. Explain the importances of natural language processing. What are the issues in the natural language processing?

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Bhadra

Exam.		Regular	
Level	BE	**Full Marks**	80
Programme	BEL, BEX, BEL, BCT	**Pass Marks**	32
Year / Part	IV / I	**Time**	3 hrs.

Subject: - Organization and Management (*ME 708*)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ Assume suitable data if necessary.

1. Explain the historical development of the organization. Distinguish between formal and informal organizations. [3+5]

2. Are Fayol's principles of management applicable in today's organization? How? [8]

3. What do you mean by co-operative societies and describe different types of co-operatives. [8]

4. Explain the advantages of line and staff organization over line and function organization and describe the committee and its types. [4+4]

5. Explain the policies of personnel mangement. How can you identify the training needs of manpower in an organization? [5+3]

6. Explain the following: [4×2]

    a) Job analysis
    b) Job evaluation
    c) Merit rating
    d) Recruitment

7. Describe about the motivational theory and explain about the Herzberg's hygiene maintenance theory. [4+4]

8. Explain about the entrepreneurship and describe the steps for establishing a small scale unit of entrepreneurship. [4+4]

9. What is case study? Explain the steps involves in case study. [8]

10. Write short notes on: (Any Two) [2×4]

    a) Organization Structure
    b) Marketing
    c) Entrepreneurial characteristics

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Baishakh

Exam.		Back	
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Organization and Management *(ME 708)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Define organization as a system. Describe the concepts of organization in this respect. Is it possible to have an informal organization within the same family? [2+2+4]

2. Describe any two principal functions of a manager. Why do you think that these two functions are most important functions in an organization? What is the difference between organization and management? [4+2+2]

3. What is difference between Administrative Management Approach and Behavioral Management Approach? What is the rationale for Scientific Management Approach? [4+4]

4. Why joint stock company is better than partnership firm? Discuss the process of a private company registration in Nepal, including the types of documents required. [3+5]

5. How important is marketing in business? What are the different methods of purchasing? [4+4]

6. How would HR Manager tackle with the problem of talent poaching in the modern industries? Elaborate how HR manager would implement employee development program with short term plans. [4+4]

7. Define Intrinsic Motivation. Explain McGregor's Theory X and Theory Y of Motivation. [2+6]

8. Explain Blake's and Mounton's managerial grid. Describe different leadership approach. [4+4]

9. Why do we need MIS in addition to various softwares for specific tasks in an organization? What is the significance of Executive Information System (EIS) for top level managers? [4+4]

10. Entrepreneurship is not only the creativity of entrepreneur but also strongly need the conductive environment for entrepreneurship. Elaborate with your own logic. [8]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Organization & Management (ME 708)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt _All_ questions.
✓ The figures in the margin indicate _Full Marks_.
✓ Assume suitable data if necessary.

1. Explain the importance of organization in the society. Define the term informal Organization. [5+3]

2. Explain behavioral management approach theory. What are the basic skills and function required for management? [3+5]

3. What advantages does joint stock organization has over partnership organization? Explain the features of line organization. [4+4]

4. Explain the role of purchasing and marketing department in the organization. [8]

5. Explain the role of personnel management in the organization. Why do we need manpower planning in the organization. [4+4]

6. What do you mean by incentives. Explain the different factors affecting the wage/salary structure. [4+4]

7. Define the term motivation and explain different technique of motivation. [4+4]

8. Describe Trait Approach of Leadership. Explain the Vroom's Expectancy theory of motivation. [4+4]

9. What are the qualities of a good leader? Explain the term entrepreneurship. [5+3]

10. Define the term MIS. Explain the value of MIS in the planning process. [3+5]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Ashwin

Exam.		Back		
Level	BE		Full Marks	80
Programme	BEL, BEX, BCT		Pass Marks	32
Year / Part	IV / I		Time	3 hrs.

Subject: - Organization and Management *(ME 708)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Define organization and management. What are the principles of organization? [2+6]

2. Describe various roles for a manager to play in an organization. Briefly mention the different models of management. [4+4]

3. What advantages does Joint stock Organization has over Partnership Organization? Explain the features of line Organization. [4+4]

4. Draw an outline of purchasing process for an organization. What are the challenges for marketing of software products in Nepal? [4+4]

5. Explain the role of Personnel Management in the organization. Why do we need manpower planning in the organization? [4+4]

6. How do you see the significance of Blake and Mouton's managerial grid for organization's growth? Explain. [8]

7. Define Motivation. Explain the features of Maslow's hierarchy of needs. [3+5]

8. Describe the role of entrepreneurship in the development of IT sector in Nepal. What are the risks and challenges for an aspiring entrepreneur in Nepalese IT sector? [5+3]

9. What is the relationship between computers and management information system? Explain how information systems can be organized in proper way? [2+6]

10. Define the term MIS. Explain the value of MIS in the planning process. [3+5]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Chaitra

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Organization and Management *(ME708)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt _All_ questions.
✓ The figures in the margin indicate _Full Marks_.
✓ Assume suitable data if necessary.

1. Define organization. What are the roles of an organization for professional growth and development of an employee? Do we need informal organization indeed? [2+4+2]

2. What are the function of Management? Briefly explain the features of scientific management theory. [4+4]

3. What is the significance of Human Resource Manager in modern organization? Elaborate how HR manager would implement Scientific Management Approach? [4+4]

4. Define the term Marketing. Explain the importance of Marketing in an Organization. [3+5]

5. What are the functions of personal management? How wages are calculated? [5+3]

6. What kind of salary and benefits do you expect when you join an organization? Explain interviewing process. [5+3]

7. What do you mean by motivation? Why is the theory proposed by Maslow on hierarchy of human needs called satisfaction progression process? Explain with examples. [3+5]

8. What is the difference between a leader and manager? How do you want to pursue your career in future? What are the challenges for a good leader in modern times? [4+2+2]

9. Describe Democratic Leadership style. Explain Behavioral approach of leadership. [4+4]

10. Write short notes on: (Any two) [4+4]

    a) Manpower planning
    b) Organizational structure
    c) Satisfaction progression Vs Frustration Regression Process

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Exam.		Back	
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Organization and Management (ME708)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt All questions.
✓ The figures in the margin indicate Full Marks.
✓ Assume suitable data if necessary.

1. Define organization. Why do we need organization? Can we sustain without organization? [2+3+3]

2. What are the functions of management? Explain different levels of management? What are the qualities of good manager? [3+2+3]

3. What is difference between Administrative Management Approach and Behavioral Management Approach? What is the rationale for Scientific Management Approach? [4+4]

4. Discuss on different steps for formation of Joint Stock Company. Explain the merits and demerits of Committee organization. [4+4]

5. What is personnel management? What must a good personal policy include?

6. Differentiate between attitude, group and executive motivation. List the techniques of motivation. [8]

7. Explain Blake's and Mouton's managerial grid? Describe different leadership approach? [8]

8. What is entrepreneurship? Why is there need for promotion of entrepreneurship in developing nation? [8]

9. Describe how you envision yourself as a leader in the future professional career. What are the qualities of a good leader? [4+4]

10. Describe how data and information are used in an officer. What is the difference between Decision Support System (DSS) and Management Information System (MIS)? [4+4]

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Exam.		Regular	
Level	BE	**Full Marks**	80
Programme	BEL, BEX, BCT	**Pass Marks**	32
Year / Part	IV / I	**Time**	3 hrs.

Subject: - Organization and Management *(ME708)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Define Formal and Informal organization. Discuss on principles of organization. [2+6]

2. Why is there a need for different levels of management? What are the managerial skill a modern manager needs to be equipped with? [4+4]

3. What are advantages of line and staff organization over line organization and functional organization? Explain committee organization and its types. [4+4]

4. Suppose you are chief executive officer (CEO) of a software company. Which type of ownership would you prefer? And why? Suggest suitable organizational structure for it with figure. [4+4]

5. What is the importance of Personnel Policy in an organization? Discuss pros and cons of referral approach for manpower recruitment this competitive world. [4+4]

6. Explain how Vroom insists on importance of reward through his VIE theory for motivation. [8]

7. What do you mean by human need? How is need used for motivation? Explain the Herzberg's hygiene theory of motivation. [2+2+4]

8. Describe why you would / or would not undertake a startup after graduation. What are the risks and challenges for an aspiring entrepreneur in Nepal society? [5+3]

9. Having spent more than 3 years in a particular college/campus of yours, what are the recommendations you wish to propose to the college management for the future improvement that would it turn boost up overall academic performance and image of the college? [8]

10. Briefly describe about the information support required in different functional areas of management. [8]

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Exam.	Back		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Organization and Management *(ME708)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Define the term organization. What impact do different organizations have over our society? [3+5]

2. Which Management theory is best suited for the organizations in Nepal? [8]

3. Explain the features of Partnership Organization. What difficulties can a Partnership Organization possibly face? [3+5]

4. How important is Marketing in business? What are the different methods of Purchasing? [4+4]

5. Define Personnel Management. How important is discussing Personnel Policy/Employee Handbook to newly hired employee? [3+5]

6. What do you mean by incentives? Explain the different factors affecting the wage/salary structure. [3+5]

7. Define the term Motivation and explain Maslow's theory of motivation. [3+5]

8. Define the term leadership. Which leadership style is appropriate in the engineering project? Comment. [3+5]

9. Define the term Entrepreneurship. Explain entrepreneurship characteristic. [3+5]

10. Define the term MIS. What do you mean by website? Explain the role of computer for management information system. [2+2+4]

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Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Organization and Management *(ME708)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Describe the role of organizations for human civilizations? What are the characteristics of an organization for business operations? [4+4]

2. State and define various levels of management. What are the various skills necessary to be an efficient manager? [4+4]

3. Which type of organizational structure is best suited for a temporary engineering project? Present your logic. [8]

4. Define the term marketing and why marketing is important in an organization? [8]

5. What is the role of interview in manpower hiring process? What is difference between wage and salary? What is an incentive and why is it needed? [3+3+2]

6. What do you understand by the term Motivation? Explain Herzberg's Hygiene Maintenance Theory. [3+5]

7. What is Leadership? In your opinion, which type of leadership is most efficient in Nepal? Present your views and logic. [3+5]

8. What is the importance of entrepreneurship for national economy in Nepali context? What is the significance of law enforcement for entrepreneurship? [4+4]

9. Differentiate between a Boss and Leader in terms of various Leadership styles you have studied. [8]

10. What are the Objectives of Case study? Explain the needs, function and importance of MIS in organizations of today's modern world. [4+4]

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Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Organization and Management (ME708)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Explain the term organization. Explain the difference between Formal and Informal organization. [3+5]

2. Define the term management and explain the function of management. [3+5]

3. What advantage does Behavioral Management theory has over Scientific Management Theory. Explain in detail. [8]

4. An organization may change its form of ownership. Explain this with some examples. [4+4]

5. Explain the importance of marketing in modern business. Salesmanship is an important ingredient of marketing. Do you agree with this statement? [4+4]

6. Why is personnel Policy necessary to be discussed? Discuss the importance of Manpower Planning. [5+3]

7. What is difference between appropriate and inappropriate human resources? List out some idea to elaborate them concerning with "Human Resources Management". [8]

8. Discuss the role of management in Motivation. Explain McGregor's theory X and theory Y. [3+5]

9. Entrepreneurship is not only the creativity of entrepreneur but also strongly need the conducive environment for entrepreneurship. Elaborate with your logic. [8]

10. Explain the importance of Management Information System (MIS). Explain information support for functional areas of Management. [4+4]

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Organization and Management *(ME708)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Why do we need organizations? Describe the principles of an organization. [4+4]

2. State and explain the different levels of Management. What are the basic skills required for Management? [4+4]

3. What is the difference between Scientific Management and Management Science? How do Taylor's principles illustrate importance of Scientific Management for production processes? [3+5]

4. Which organization structure is more suitable to engineering project? Discuss with your logic. [8]

5. Explain the different methods of Purchasing. Why is advertising one of the best form of Marketing? [5+3]

6. What is the difference between recruitment and hiring? Why do we need incentives in an organization? [4+4]

7. What are the different factors that affect wage / salary structure? Explain different methods of Training Manpower. [4+4]

8. What is the difference between theory 'X' and theory 'Y'? Explain on the basis of different theory of motivation. [8]

9. Describe Autocratic Leadership Style. Explain the different characteristics of Entrepreneur. [3+5]

10. If you are asked to prepare the case study considering the planning horizon, leadership, motivation and human resource development for either Nepal Electricity Authority or Nepal Telecom to improve the existing performance of these institution. How do you prepare case study following its structure? [8]

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Exam.	**New Back (2066 & Later Batch)**		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Organization and Management *(ME708)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ __All__ questions carry equal marks.
✓ Assume suitable data if necessary.

1. Define organization and explain the principle of organization.

2. What do you mean by management? Explain the function of management.

3. Explain Henry Fayol's 14th principle of management.

4. What do you mean by co-operative societies? Explain different types of co-operatives.

5. What do you mean by purchasing? Explain different function of purchasing department.

6. Define personal management and explain function of personal management.

7. What do you mean by incentive? Explain different factors of salary structure.

8. Define motivation and explain different technique of motivation.

9. Define leadership and explain different qualities of good leader.

10. How information system support for functional area of management.

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Chaitra

Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: – Organization and Management *(ME 708)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Why is an organization necessary? Explain the principles of an organization. [4+4]

2. What are the differences between the terms organization and management? Why do you need scientific approach of management to an organization? [2+2+4]

3. What do you mean by organizational structure? How is it defined for a particular enterprise? Write advantages and disadvantage of line organization. [2+2+4]

4. What do you mean by purchasing and procurement? Explain the functions of marketing. [3+5]

5. Explain the motive behind personnel management? Describe various functions of personnel management. How does Human Resources Management System differ from personnel management? [2+4+2]

6. Define the term job analysis and explain scientific selections of manpower. [5+3]

7. What do you mean by Human need? How is a need used for motivation? Explain Herz Berg's Hygine theory of motivation. [2+2+4]

8. A reader is leader. Elaborate it in terms of leadership styles. What are the differences between a leader and a manager? [5+3]

9. Define Management Information System (MIS). Describe briefly about different types of Information System and their support to managers in decision making. [5+3]

10. What are the objectives of a case-study? Explain the needs, functions and importance of MIS. [3+5]

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Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Organization and Management (ME708)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. What are the principles of organization? Explain formal and informal organization.   [4+4]

2. What are the managerial skills? Explain the importance of management.   [4+4]

3. What are the forms of ownership? Explain advantages and disadvantages of single ownership organization.   [4+4]

4. What do you understand by behavioral management approach? Explain administrative management approach.   [4+4]

5. What are the methods of purchasing? Explain the various functions of marketing.   [4+4]

6. What is personnel management? Explain recruitment and selection of staff.   [3+5]

7. What do you mean by Training and Development of Human resources? Explain various incentives used in organization.   [5+3]

8. What is motivation? Explain the difference between Maslow's Heirarchical need theory and Alderfer's ERG theory.   [3+5]

9. Define the term Entrepreneurship and write the steps for establishing a small scale unit of Entrepreneurship.   [3+5]

10. Write short notes on: (any two)   [4×2]
    i) Objective of Case Study
    ii) Organization structure and
    iii) Organizing Information systems

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEL, BEX,BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Organization and Management *(ME708)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Describe why organization is considered as an open system. Explain the importance of organization. [4+4]

2. Name the different models of management. Explain any three of them in detail. [3+5]

3. State and describe H.Fayol's administrative management theory. [8]

4. What is meant by 'Joint Stock Company'? Describe the procedure for forming 'Joint Stock Company'. [3+5]

5. Define marketing, advertising. Explain the function of purchasing in detail. [3+5]

6. Define the term personnel management. Explain the function of personal management. [3+5]

7. Define merit rating. State and describe the various methods of merit rating. [2+6]

8. What do you mean by human needs? Describe A. Maslow's hierarchy of needs theory in detail. [3+5]

9. Define leadership and explain by Blakes and Mouton's Management Grid. [3+5]

10. Define Management Information System. Explain information support for functional areas of management. [2+6]

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Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Organization & Management (ME708)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt any Ten questions.
✓ The figures in the margin indicate Full Marks.
✓ Assume suitable data if necessary.

1. What are the principles of Organization? Explain the Informal Organization.   (4+4)
2. Explain the importance of Management and discuss the different function of Management.   (3+5)
3. Explain Administrative Management Theory.   (8)
4. What do you mean by organization structure? Explain Line Organization.   (4+4)
5. Define the term purchasing. Explain different function of Purchasing department.   (3+5)
6. Define the term Personnel management and explain its functions.   (8)
7. What do you mean by incentives? Explain the different factors affecting the wage/salary structure.   (3+5)
8. Define the term Motivation and explain different technique of motivation.   (3+5)
9. Define the term leadership and Explain the different qualities of good leader.   (3+5)
10. a. Define the term Entrepreneurship.   (3)
    b. Explain the Vroom's Expectancy theory of Motivation.   (5)
11. What do you mean by Case study? Explain the objective of case study.   (4+4)
12. Define term MIS. How information support for functional areas of management?   (3+5)

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Organization and management (ME708)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt All questions.
✓ The figures in the margin indicate Full Marks.
✓ Assume suitable data if necessary.

1. Define Organization. Explain the importance of Organization in society. [3+5]

2. Define the term Management and explain different levels of Management. [3+5]

3. What do you mean by Joint Stock Company? Explain the advantages and limitations of a Joint Stock Company. [2+6]

4. What do you mean by motivation? Describe Maslow's hierarchy of needs briefly. Can Maslow's theory explain tireless quest of Laxmi Prasad Devkota for excellent literary works? [2+3+3]

5. Explain the process of recruitment and selection of man power in an organization. What do you mean by outsourcing in this context? [6+2]

6. a) Explain different Techniques of Motivation. [4]

   b) Define term contingency approach of Leadership. [4]

7. Define the term Entrepreneurship and explain the characteristics of Entrepreneurship. [3+5]

8. Define Management Information System. Describe briefly various types of Management Information System. [2+6]

9. Silicon Valley is the best example of successful entrepreneurship. Elaborate with your thoughts. [8]

10. Write short notes on: (any two) [2×4]

    a) Computer aided Advertising
    b) Objectives of case study
    c) Satisfaction progression Vs. Frustration Regression Process

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INSTITUTE OF ENGINEERING

Examination Control Division

2068 Chaitra

Exam.	Regular / Back		
Level	BE	**Full Marks**	80
Programme	BEL, BEX, BCT	**Pass Marks**	32
Year / Part	IV / I	**Time**	3 hrs.

Subject: - Organization and Management

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt any **Five** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. a) How can organization behavior be affected by management? Explain all the elements of an organization. [4+4]

   b) Define management. Explain contingency and system approach of management. [3+5]

2. a) How are Policy group and Executive groups different in an organization? Differentiates between marketing and purchasing. [4+4]

   b) What is organization structure? Differentiate between responsibility and authority. Explain functional organization with sketch. [2+3+3]

3. a) What is MIS? Why is hierarchy of information system necessary in an organization? Write in brief. [3+5]

   b) Justify that information system is vital for planning and control process in an organization. [8]

4. a) What is motivation? Write differences between Maslow's hierarchical need and Alderfer's ERG theory of motivation. [3+5]

   b) Why is leadership necessary in an organization? Explain various leadership styles. [3+5]

5. a) What do you understand by personnel management? Explain job description. [4+4]

   b) Explain recruitment and selection process in detail. [8]

6. Write short notes on: (any four) [4×4]

   a) Scientific Management
   b) Span of control
   c) Needs for MIS
   d) Management by objective
   e) Collective bargaining

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2068 Baishakh

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEL , BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: – Organization and Management

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt any *Five* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ Assume suitable data if necessary.

1. What is meaning of organization? Explain organization behavior as a multidisciplinary field. Explain the Scientific Management theory. [4+4+8]

2. What do you understand by policy and executive groups in an organization? Explain functional organization. What is responsibility and authority? Explain matrix organization chart. [4+4+3+5]

3. Why is MIS necessary for management? Explain computer and MIS. What is information Architecture? Explain database information system. [4+4+3+5]

4. Explain the two factors theory of motivation. How can you determine the most effective leadership style? Define the term informal organization. [5+7+4]

5. Define the term personnel management. Explain the different factors of wage and salary structure. What are the methods of performance appraisals? [4+8+4]

6. Write short notes on: (Any Four) [4×4]

   a) Leadership style
   b) Information system for planning process
   c) Marketing concept
   d) Database information system
   e) Incentive programs

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Exam.		Regular/Back	
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Organization and Management

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt any *Five* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ Assume suitable data if necessary.

1. Differentiate between private limited and public limited company. Explain organization behaviour as a multidisciplinary field. What are the importance of contingency theory of management? [5+4+7]

2. What do you mean by purchasing and marketing concept? Explain the manufacturing methods in industrial organization. What do you mean by span of control in a line organization? [5+6+5]

3. Explain the importance of management information system. Discuss the role of information in the planning process. What do you mean by network information system? [5+6+5]

4. Discuss the Herzberg's theory of motivation. How will you determine the most effective leader in the business organization? Define the term informal organization. [6+6+4]

5. Explain the term job description. What are the processes of collective bargaining? Discuss the different steps of hiring and selecting staff. [4+6+6]

6. Write short notes on: (any four) [4×4]

   a) Partnership organization
   b) Industrial relation
   c) Job design and work efficiency
   d) Functional organization
   e) Computer integrated manufacturing plants

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Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BEL, BEX, B.CT.	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Organization and Management

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt any **Five** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. What do you mean by organization behaviour? Explain the functions of management. Discuss the behavioural management theory.   [4+4+8]

2. Discuss the activities of production development. What do you mean by industrial relation? Define the term line and staff organization.   [5+6+5]

3. Discuss the hierarchy of information needs. What are the role of information system for decision making process? Explain database information system.   [5+6+5]

4. What are the motivational theory of Herzberg's hygiene factors and motivational factors? Discuss the behavioural approach of leadership. Define the term authority and power.   [6+5+5]

5. What do you mean by job analysis? Discuss the different steps of hiring and selecting staff. Explain the methods of performance appraisal.   [6+5+5]

6. Write short notes any four of the following: [4×4]
   a) Contingency Management Theory
   b) Needs for Management Information System (MIS).
   c) Contingency Approach of Leadership
   d) Incentive Programs
   e) Value of Case Study

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Subject: - Digital Signal Analysis And Processing (CT 704)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Define energy and power signal. Determine whether the signal $x[n] = \cos[\dfrac{2\pi n}{5}] + \sin[\dfrac{\pi n}{3}]$ is periodic or non-periodic and if it is periodic, find its fundamental period. [2+2]

2. Find the output of LTI system having input signal $x[n] = \delta[n]+2\,\delta[n-1]-\delta[n-3]$ and $h[n] = 2\delta[n+1] +2\delta[n-1]$. [5]

3. Find inverses Z-transform of $X(z) = (2z^4+2z^3-3z+2)/(z^2-1.5z-1)$, ROC:$|z|<0.5$, using partial fraction expansion method. [6]

4. Plot the pole-zero in z-plane and draw the magnitude response (not to the scale) of the equation of the system describe by difference equation:
   $y[n] - 0.35y[n-1] + 0.25\,y[n-2] = x[n] -0.75\,x[n-1]$. [3+7]

5. Draw direct form I and Direct form II realization of the following system.
   $y[n] - 0.25\,y[n-2] + x[n] + 0.4x[n-1] + 0.5x[n-2]$ [2+2]

6. Given a 3-stage lattice filter for all zero polynomial with coefficients $K_1 = 1/4$, $K_2 = 1/2$ and $K_3 = 1/3$. Obtain the system function and FIR filter coefficients of this filter. [6]

7. Define Gibb's phenomenon. Design the FIR filter using Kaiser window technique for the specifications: [2+8]

   $0.899 \le |H(e^{jw})| \le 1$ \qquad for $|w| \le 0.2\pi$

   $|H(e^{jw})| \le 0.01$ \qquad for $0.4\pi \le w \le \pi$

8. Discuss the Remez exchange algorithm for FIR filter design. [5]

9. Design a low pass discrete time Butterworth filter using bilinear transformation having following specifications: [11+4]

   Passband frequency $(W_p) = 0.25\pi$ radians
   Stopband frequency $(W_s) = 0.55\pi$ radians
   Passband ripple $(\delta_P) = 0.11$
   Stopband ripple $(\delta_S) = 0.21$. Consider sampling frequency of 0.5 Hz.

   Also, covert the obtained digital low pass filter to high pass filter with new pass band frequency, $W'_P = 0.45\pi$ using digital domain transformation.

10. Why we need FFT? Find the 8-point DFT of the following sequence using radix-2 DITFFT algorithm. [2+6]

11. If $X_1(k)$ and $X_2(k)$ are DFT of sequence $x_1[n] = \{1, 0, 0, 1\}$ and $x_2[n] = \{2, 0, 2\}$ respectively then find the sequence $X_3[n]$; if DFT of $x_3[n]$ is given by $X_3(k) = X_1(k) \cdot X_2(k)$. [7]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Baishakh

Exam.		Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Digital Signal Analysis and Processing *(CT 704)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ Assume suitable data if necessary.

1. Compare between energy signal and power signal. Determine whether the signal $x[n] = e^{j(\frac{\pi}{2}n + \frac{4\pi}{7})}$ is energy signal or power signal. [2+2]

2. Find the output of LTI system having impulse response $h[n] = \left(\frac{1}{2}\right)^n \{u[n+2] - u[n-2]\}$ to the input $x[n] = \{2, 1, 0, -1, 4\}$. [5]

3. Define z-transform for a discrete time signal. Find the inverse z-transform for $H(z) = \dfrac{z}{3z^2 - 4z + 1}$ using partial fraction method for $\frac{1}{3} < |z| < 1$. [1+5]

4. Plot the pole-zero in z-plane and draw magnitude response (not to the scale) of the system described by difference equation [3+7]
    $$y[n] - 0.3\,y[n-1] + 0.2y[n-2] = x[n] - 0.5x[n-1]$$

5. Compute Lattice-ladder coefficients and draw lattice structure for given system $H(z) = (1 - 0.4z^{-1} + 0.25z^{-2}) / (1 - 0.3z^{-1} + 0.5z^{-2})$. Also check the stability of given system. [6+1]

6. Obtain the Direct Form I and Direct Form II realization of the following system: [4]
    $$y[n] - 0.75y[n-1] - 0.25y[n-2] = x[n] + 0.5x[n-1]$$

7. Design a low pass digital FIR filter having Pass band edge frequency $\omega_p = 0.2\pi$, Stop band edge frequency $\omega_s = 0.45\pi$ and Stop band attenuation $\alpha_s = 51$ dB using any appropriate window function. [5+3]

8. What do you understand by optimum filter? Describe Remez exchange algorithm for FIR filter design along with the flowchart. [1+6]

9. Design a low pass digital IIR filter by Bilinear Transformation method to an approximate Butterworth low pass filter, if passband edge frequency is 0.24 π radians and maximum deviation of 0.98 dB below 0 dB gain in the passband. The maximum gain of -14.95 dB and frequency is 0.57 π radians in stopband, consider sampling frequency 0.5 Hz. Compare impulse invariance method with bilinear transformation method. [11+3]

10. Why we need DFT? Find 8-point DFT of sequence $x[n] = \{1, 2, 4, 3, 5, -1, 3\}$ using Decimation in Frequency Fast Fourier Transform (DIFFFT) algorithm. [2+6]

11. Find the circular convolution of the sequences $x_1[n] = \{1, -1, -2, 3, -1\}$ and $x_2[n] = \{1, 2, 3\}$. [7]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Bhadra

Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Digital Signal Analysis and Processing *(CT 704)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Determine whether the signal $x[n] = cos\left[\dfrac{\pi n}{2}\right].cos\left[\dfrac{\pi n}{4}\right]$ is periodic or non periodic and if it is periodic, find its fundamental period. [4]

2. Find the output of LTI system having impulse response $h[n] = u[n] - u[n-4]$ and input signal $x[n] = (1/2)^n u[n]$. [5]

3. Define ROC. Find inverse z-transform of $X(z) = (z^3 +z^2 +1.5z +0.5)/(z^3+1.5z^2 +0.5z)$, ROC : $|z| < \frac{1}{2}$. [1+5]

4. Determine the zero-input response for a second order system given by: [4]

$$y[n] - 3y[n-1] - 4y[n-2] = x[n]$$

5. Plot the pole-zero in z-plane and draw magnitude response (not to the scale) of the system described by difference equation. [2+4]

$$y[n] - 0.4 y[n-1] +0.25 y [n-2] = x[n] -0.4x[n-1]$$

6. The system function of a filter is $H(z) = 1 + \dfrac{13}{24}z^{-1} + \dfrac{5}{8}z^{-2} + \dfrac{1}{3}z^{-3}$. Draw the Direct Form and Lattice Structure implementation of the above filter. [3+7]

7. Design a linear phase FIR filter using KAISER window to meet the following specifications: [8]

$$\begin{cases} |H(e^{jw})| \le 0.01; & 0 \le w \le 0.25\pi \\ 0.95 \le |H(e^{jw})| \le 1.05; & 0.35\pi \le w \le 0.6\pi \\ |H(e^{jw})| \le 0.01; & 0.65\pi \le w \le \pi \end{cases}$$

8. What is optimum filter? Show mathematical expression of Remez exchange algorithm for FIR filter design. [1+6]

9. Design a LPF Butterworth filter using Impulse Invariance Method (IIM) method with passband and stopband frequencies 200Hz and 500Hz respectively. The passband and stopband attenuations are 5dB and 12dB respectively. The sampling frequency is 5000Hz. What is pre-warping and why it is necessary? Explain. [12+3]

10. Differentiate between DFT and DTFT. Find the circular convolution of $x_1[n]=\{2, 1, 2, 1\}$ and $x_2[n] = \{1, 2, 3, 4\}$ [2+6]

11. Find the 8 – point DFT of $x[n] = u[n] - u[n-4]$ using FFT DIT algorithm. [7]

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Subject: - Digital Signal Analysis and Processing (CT 704)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt All questions.
✓ The figures in the margin indicate Full Marks.
✓ Assume suitable data if necessary.

1. Define even and odd type discrete time signals with suitable example. Plot the signal $x[-2n+3]$ where $x[n] = \{1, 2, 0, -1, -3, -4\}$. [2+3]

2. Determine whether the following system are: [5]
   a) $y[n] = x[-n]$ is time-invariant or not.
   b) $y[n] = x[n^2]$ is linear or not.

3. Find the output of LTI system having input signal $x[n] = u[n+1]-u[n-4]$ and impulse response $h[n] = (1/2)^n u[n-1]$. [6]

4. Define ROC of z-transform. Find inverse z-transform using partial fraction expansion of $X(z) = (z^4 + 5z^3 - 3z + 4)/ (z^2 - 1.5z - 1)$, ROC: $|z| < 0.5$. [2+6]

5. Draw the pole-zero in the z-plane for a system with poles at $0.45 \pm j1.06$ and zeroes at $0.58 \pm j2.06$. Also plot the magnitude response (not to the scale) of the system. [2+6]

6. Compute Lattice and Ladder coefficients and Draw lattice-ladder structure for given IIR system $H(z) = (0.5 - 2z^{-1} + 3z^{-2})/(1 - 0.5z^{-1} - 0.7z^{-2} + 0.3z^{-3})$. [6+4]

7. Realize the given system in Cascade form of 2nd order section in signal flow graph representation. [4]

   $H(z) = \{(1 - 0.5z^{-1})(1 + 0.35z^{-1})(1 - 0.3e^{j2n\pi/5}z^{-1})(1 - 0.3e^{-j2n\pi/5}z^{-1})\} / \{(1 - 0.6e^{jn\pi/3}z^{-1})$
   $(1-0.6e^{-jn\pi/3}z^{-1}) (1+0.5e^{j2n\pi/7}z^{-1}) (1+0.5e^{-j2n\pi/7}z^{-1})$

8. Design the FIR filter using suitable window for the specifications: [6]
   $0.899 \le |H(e^{j\omega})| \le 1$, for $|\omega| \le 0.2\pi$
   $| H (e^{j\omega})| \le 0.01$, for $0.4\pi \le \omega \le \pi$

9. What is optimum filter? Show mathematical expression of Remez exchange algorithm for FIR filter design. [1+5]

10. Design a digital low pass Butterworth filter by applying bilinear transformation techniques for the given specifications: [10]
    Passband peak to peak ripple $\le$ 1dB
    Passband edge frequency = 1.2KHz
    Stopband Attenuation $\ge$ 40dB
    Stopband edge frequency = 2.5 KHz
    Sample rate = 8KHz

11. Find 8-point DFT of sequence $x[n] = \{1, 2, 3, 3, 5, 0, 4, 6\}$ using Decimation in frequency Fast Fourier Transform (DIFFFT) algorithm. [7]

12. Find $x_3[n]$ if DFT of $x_3[n]$ is given by $X_3(k) = X_1(k) * X_2(k)$ where $X_1(k)$ and $X_2(k)$ are 4-point DFT of $x_1[n]=\{1, 2, -2\}$ and $x_2[n] = \{1, 2, 3, -1\}$ respectively. [5]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Ashwin

Exam.		Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Digital Signal Analysis and Processing (CT 704)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Explain Fourier transform multiplication property for two sequences. Write Drichlet's conditions for Fourier series. [4+3]

2. Find convolution between two signals $x[n] = 2^n 4[-n]$, $0 < a < 1$ and $h[n] = 4[n]$ [6]

3. State Convolution property of Z-transform. Find inverse Z-transform of
$$X(z) = z / \{(z - 0.6)(z + 0.5)^2\}, \text{ ROC: } |z| > 0.6$$ [3+6]

4. Describe stability and causality characteristics of LTI system in terms of Impulse Response and ROC of its transfer function with suitable examples. [4+3]

5. Compute Lattice and Ladder coefficients and Draw lattice-ladder structure for given IIR system $H(z) = (0.7 - 1.5z^{-1} + 0.5z^{-2}) / (1 - 0.5z^{-1} - 0.7z^{-2} + 0.3z^{-3})$ [6+3]

6. For the system described by the following difference equation: [2+8]
$$y[n] = 0.67x[n] - 0.3x[n-1] + 2.75y[n-1]$$

   Map the poles and zero in the z-plane and plot the phase response of the system.

7. Design a low pass discrete IIR filter by Bilinear Transformation method to an approximate Butterworth filter having specifications as below: [12]

   Pass bandedge frequency $(\omega_p) = 0.22\,\pi$ radians
   Stop bandedge frequency $(\omega_s) = 0.54\,\pi$ radians
   Passband ripple $(\delta_p) = 0.11$
   Stopband ripple $(\delta_s) = 0.22$,   Consider sampling frequency 0.5 Hz.

8. Why we need DFT? Find 8-point DFT of sequence $x[n] = \{1, 2, 3, 3, 5, 1, 4, 2\}$ using Decimation in frequency Fast Fourier Transform (DIFFFT) algorithm. [2+8]

9. In which case do we choose FIR filter and IIR filter? Design a Kaiser Window to meet the following specifications. [2+4+4]

$$0.99 \le |H(e^{jw})| \le 1.01, \quad \text{for } 0 \le w \le 0.16\pi$$

$$|H(e^{jw})| \le 0.01, \quad \text{for } 0.18\pi \le w \le 2\pi$$

   Draw the flow chart for Remez- Exchange algorithm

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31 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Ashwin

Exam.		Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Digital Signal Analysis and Processing (CT704)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ Assume suitable data if necessary.

1. Determine whether the following sequences are linear or not: [3+3]

   a) $y[n] = x^2[n]$

   b) $y[n] = \cos\left(\dfrac{5\pi}{8}n + \dfrac{\pi}{4}\right)$

2. Find the output of LTI system having impulse response $h[n] = 2^n * \{u[n] - u[n-3]\}$ and input signal $x[n] = \delta[n] + \delta[n-1] + \delta[n-2]$. [5]

3. List out the properties of Region of convergence and locate the ROC of the following signal. [3+6]

   $x[n] = (0.6)^n u[n] + (0.25)^n u[n]$

4. Draw the poles and zeros in the z-plane for a system with poles at $0.45 \pm j1.06$ and zeros at $0.58 \pm j2.06$. Also plot the magnitude response of the system. [2+8]

5. Draw the Lattice structure from the following system function: [7+3]

   $$\dfrac{1}{3 + \dfrac{39}{24}Z^{-1} + \dfrac{15}{8}Z^{-2} + \dfrac{3}{9}Z^{-3}}$$

   And represent $\dfrac{5}{8}$ and $-\dfrac{5}{8}$ in sign magnitude, 1's complement and 2's complement format.

6. Design a digital low-pass filter with the following specification: [12]

   i) Pass-band magnitude constant to 0.7 dB below the frequency of $0.15\,\pi$
   ii) Stop-band attenuation at least 14 dB for the frequencies between 0.6π to π

   Use Butterworth approximation as a prototype and use bilinear transformation method to obtain the digital filter.

7. Design a linear phase FIR filter using Kaiser Window to meet the following specifications: [8+4]

   $0.99 \le |H(e^{jw})| \le 1.01$, for $0 \le w \le 0.19\pi$

   $|H(e^{jw})| \le 0.01$, for $0.21\pi \le w \le \pi$

   Draw the flow chart for Optimum filter design.

8. How fast is FFT compare to DFT? Draw the butterfly diagram of 8-point DFT of a sequence as $x[n] = n+1$ using Decimation in Time FFT algorithm. [3+7]

9. State the circular convolution property of DFT. Find the circular convolution of: [1+5]

   $x_1(n) = \{1, 2, -1, 1\}$ and $x_2(n) = \{1, 3, 5, 7\}$

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Chaitra

Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Digital Signal Analysis and Processing (CT 704)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Define Power and Energy type discrete time signal with suitable example. Differentiate between Fourier Series and Fourier Transform. [3+4]

2. Find the output of LTI system having impulse response h[n] with $h[-2] = 3$, $h[0] = 2$, $h[1] = 1$ and input signal $x[n] = (2)^n$, for $-1 \le n \le 3$. Also check the answer. [5+2]

3. Plot the pole-zero in z-plane and draw magnitude response (not to scale) of the system described by differential equation
$$y(n) - 0.3y(n-1) = 2x(n-2) + 0.7x(n-1) + 4x(n)$$
[2+7]

4. Draw the lattice structure from the following system function
$$H(t) = \frac{1}{1 + \frac{2}{3}z^{-1} + \frac{5}{8}z^{-2} + \frac{2}{3}z^{-3} + z^{-4}}$$
[9]

5. What is optimum filter? Show mathematical expression of Remez exchange algorithm for FIR filter design. [2+6]

6. List out the properties of Region of convergence and locate the ROC of the following signal
$$x[n] = (0.1)^n u[n] + (0.3)^n u[-n-1]$$
[4+6]

7. Using bilinear transformation, design a digital filter using Butterworth approximation which satisfies the following conditions

$0.8 \le | He^{JW} | \le 1$ for $0 \le W \le 0.2\Pi$

$| He^{JW} | \le 0.2$ for $0.6\Pi \le W \le \Pi$
[10]

8. How fast is FFT? Find X(3) and X(5) for given sequence $x[n] = \{1, -2, 3, 2\}$ using DITFFT algorithm. [2+8]

9. Differentiate between linear convolution and circular convolution compute circular convolution of signals

$X_1[n] = \{0, 0, 1, 1\}$ and $X_2[n] = \{1, 1, 1, 1\}$
[3+7]

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Digital Signal Analysis and Processing (CT704)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ *Attempt __All__ questions.*
✓ *The figures in the margin indicate __Full Marks__.*
✓ *Assume suitable data if necessary.*

1. Plot the sequence $x[n] = u[n] - u[n-3] + 5\delta[n-4] + nu[n-6]$. List out the properties of LTI system. [3+2]

2. Determine whether the following system are: [3+3]

   a) $y[n] = y[n-4] + x[n-4]$ is Time-invariant or not

   b) $y[n] = x^2[n]$ is Linear or Nor-linear

3. Define a ROC. What are the properties of ROC of z-transform? Find the inverse Z-transform of $X(z) = (2z^2 + 2z^2 + 3z + 5)/(z^2 - 0.1z - 0.2), ROC : |z| < 0.4$. [1+3+5]

4. The poles of a system are located at: 0.45-0.77i and -2±0.3i. Map the poles and zero in the z-plane and plot the magnitude response of the system. [2+8]

5. Obtain the Direct Form I and Direct Form II realization of the following system. [5]

   $$3y[n] + y[n-1] + 2y[n-4] = 2x[n] + x[n-3]$$

6. Determine the lattice coefficients coefficients corresponding to the FIR filter with the system function: [5]

   $$H(z) = A_3(z) = 1 + \frac{52}{96}z^{-1} + \frac{25}{40}z^{-2} + \frac{1}{3}z^{-3}$$

7. Design a digital low-pass filter with the following specification: [12]

   i) Pass-band magnitude constant to 0.7 dB below the frequency of 0.15π

   ii) Stop-band attenuation at least 14 dB for the frequencies between 0.6π to π
       Use Butter worth approximation as a prototype and use impulse invariance method to obtain the digital filter.

8. Design a FIR linear phase filter using Kaiser window that meets the following specifications: [9+3]

   $|H(e^{jw})| \leq 0.01, 0 \leq |w| \leq 0.25\pi$
   $0.95 \leq |H(ejw)| \leq 1.05 , 0.35\pi \leq |w| \leq 0.6\pi$
   $|H(e^{jw})| \leq 0.01, 0.65\pi \leq |w| \leq \pi$
   Also determine the minimum length (M+1) of the impulse response and Kaiser window parameter β.

9. Why do we need DFT? Draw the butterfly structure to compute the DFT of the following signal using Radix-2 DIFFFT algorithm, and compute X(2) and X(1) only [3+7]
   $x[n] = \{1.5, -1, 1.8, 0.6, 3, 1.7\}$

10. Define zero padding. Find the linear convolution through circular convolution with padding of zeros for the following sequences: $x[n] = \{1,1,1,1\}$ and $h[n]\{2,3\}$. [1+5]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Ashwin

Exam.		Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Digital Signal Analysis and Processing (CT704)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Define Energy and Power type discrete time signal. Check whether signal $x[n] = e^{j(\pi n/3 + \pi/4)}$ is periodic or not. If it is periodic, state its periodic time. [2+2]

2. Find the output of LTI system having impulse response $h[n] = (1/2)^n \{u[n+2] - u[n-2]\}$ and input signal $x[n] = \{2, 1, 0.5, -1\}$. Also check the answer. [3+2]

3. State and explain the properties of a Region of Convergence (ROC). Find the inverse z-transform of $X(z) = z^2 \left[1 - \frac{3}{2}z^{-1}\right]\left(1 + z^{-1}\right)\left(1 - z^{-1}\right)$ [3+3]

4. Plot the pole-zero in z-plane and Draw Magnitude Response (not to the scale) of the system described by difference equation
$y[n] - 0.4y[n-1] + 0.2y[n-2] = x[n] + 0.5x[n-1] + 0.6x[n-2] + 0.8x[n-3]$ [3+7]

5. Draw the direct form and Lattice structure of a filter with system function
$H(z) = 1 + 0.7z^{-1} + 1.2z^{-2} - z^{-3}$. [3+7]

6. Why Kaiser window is better than other fixed windows in FIR filter design? Find out first six coefficients of impulse response of a low pass FIR filter having Pass band edge frequency $\omega_p = 0.2\pi$, Stop band edge frequency $\omega_s = 0.5\pi$ and Stop band attenuation $\alpha_s = 41\,dB$ using any appropriate window function. [2+6]

7. What is an optimum filter? Show mathematical expression of the Remez exchange algorithm for FIR filter design with flow chart. [1+6]

8. Design a low pass discrete IIR filter by Bilinear Transformation method to an approximate Butterworth filter having specifications as below: [15]

Pass band edge frequency $(\omega_p) = 0.27\,\pi$ radians
Stop band edge frequency $(\omega_s) = 0.58\,\pi$ radians
Pass band ripple $(\delta_p) = 0.11$
Stop band ripple $(\delta_s) = 0.21$, Consider sampling frequency 0.5 Hz.

9. Compute the 8-point DFT of the sequence $x[n] = \left\{\frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2}, 0, 0, 0, 0\right\}$ using Decimation in Frequency Fast Fourier Transform (DIF-FFT) algorithm. [7]

10. What is a zero padding? If $X_1(k)$ and $X_2(k)$ are DFT of sequence $x_1[n] = \{1, 2, 0, 1, -2\}$ and $x_2[n] = \{1, 0, 1, 1, 2\}$ respectively then find the sequence $x_3[n]$; If DFT of $x_3[n]$ is given by $X_3(k) = X_1(k) \cdot X_2(k)$. [1+7]

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Digital Signal Analysis and Processing *(CT704)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ Assume suitable data if necessary.

1. Define and plot a discrete time unit step signal. Explain its relation with unit impulse signal. [1+2]

2. Calculate y[n], if x[n] is x[-2] = 0.5, x[0] = 1, x[1] = 0.75, x[3] = 0.5 and n[n] is n[0] = 1, n[1] = 0.75 and n[2] = 0.5 and verify your result. [6]

3. Define a ROC. Find inverse Z-transform of $X(z) = (2z^3+2z^2+3z+5) / (z^2-0.1z-0.2)$, ROC: $|z| < 0.4$ [1+5]

4. Define the difference equation with example. The Poles of a system are located at:- 0.45 + 0.77*i* and 2 ± 0.7*i* and zeros at: 1.2 ± 0.43*i*. Plot the magnitude response of this system. [2+8]

5. Draw the Lattice Structure from the following system function: [10]

$$\frac{1+\frac{1}{3}z^{-1}+\frac{9}{8}z^{-2}+\frac{4}{3}z^{-3}+z^{-4}}{1+\frac{2}{3}z^{-1}+\frac{5}{8}z^{-2}+\frac{2}{3}z^{-3}+z^{-4}}$$

6. Design a digital Butterworth low pass filter satisfying the constraints

$$\begin{cases} 0.707 \leq |H(e^{jw})| \leq 1 & 0 \leq w \leq \frac{\pi}{2} \\ |H(e^{jw})| \leq 0.2 & \frac{3\pi}{4} \leq w \leq \pi \end{cases}$$

With T = 1sec using bilinear transformation method. Realize the filter using the most convenient realization form. [11+4]

7. Design an FIR linear phase filter using Kaiser window to meet the following specifications: [8]

$$0.98 \leq |H(e^{jw})| \leq 1.02, for\ 0 \geq w \geq 0.9\pi$$

$$|H(e^{jw})| \leq 0.01, for\ 0.14\pi \leq w \leq \pi$$

8. Draw the flowchart of Remez-Exchange theorem and explain it. [7]

9. Why we need FFT? Find 8-point DFT of sequence x[n] = {1, -1, 3, 2, 1, 1, 3, -2} using Decimation in frequency Fast Fourier Transform (DIFFFT) algorithm. [2+6]

10. Find x₃[n] if DFT of x₃[n] is given by $X_3(k) = X_1(k) X_2(k)$ where $X_1(k)$ and $X_2(k)$ are 5-point DFT of x₁[n] = {1, -2, 5, 1, 2} and x₂[n] = {1, 2, -3, -2} respectively. [7]

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Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / 1	Time	3 hrs.

Subject: - Digital Signal Analysis and Processing (CT704)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt _All_ questions.
✓ The figures in the margin indicate _Full Marks_.
✓ Assume suitable data if necessary.

1. Explain the process of calculating fourier series coefficients. [3]

2. Determine the system output $y(n)$ of the following signals: $h(n) = \{1,1,1\}$ and $x(n) = \{1,1,1,1\}$ [6]

3. Define a ROC. Find inverse Z-transform of $X(z) = z/\{(z-0.4)(z+1.5)^2\}$, ROC: $|z| < 0.4$ [1+5]

4. State linear constant coefficient difference equation and corresponding system function.

   Determine the output sequence of the system with impulse response $h[n] = (1/2)^n u[n]$ when the input signal is $x[n] = 10 - 5\sin(\pi n/2) + 20\cos \pi n \quad -\infty < n < \infty$. [3+7]

5. The system function of a filter is $H(z) = 2 + 1.8z^{-1} - 1.6z^{-2} + z^{-3}$. Draw the Direct Form and Lattice Structure implementation of the above filter. [3+7]

6. Explain in detail about how rectangular window is used in FIR filter design. How Gibb's oscillations arise in this process. [6]

7. Explain about Remaz exchange algorithm with suitable derivation and flow chart. [9]

8. Using bilinear transformation, design a butterworth low pass filter which satisfies the following Magnitude Response. [12]

   $0.89125 \leq |H(e^{jw})| \leq 1 \quad$ for $0 \leq \omega \leq 0.2\pi$

   $|H(e^{jw})| \leq 0.17783 \quad$ for $0.3\pi \leq \omega \leq \pi$

9. Explain briefly about bilinear transformation method of IIR filter design. [3]

10. Why do we need DFT? Find 8-point DFT of sequence $x[n] = \{1,-1,2,2,1,1,2,2\}$ using Fast Fourier Transform algorithm. [2+6]

11. Find $x_3[n]$ if DFT of $x_3[n]$ is given by $X_3(k) = X_1(k) X_2(k)$ where $X_1(k)$ and $X_2(k)$ are 5-point DFT of $x_1[n] = \{1,-2,2,1,4\}$ and $x_2[n] = \{2,1,-3,-1\}$ respectively. [7]

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Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Digital Signal Analysis and Processing (CT704)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. How fourier series coefficients are calculated? Explain. [4]

2. Find the output of LTI system having impulse response h[n] with h[-2] = 1, h[0] = 2, h[1] = 3 and input signal x[n] with x[0] = 1/2 , x[2] = 2, x[3] = 3. Also check the answer. [3+2]

3. Explain the properties of Region of Convergence with examples. [6]

4. Describe stability and causality characteristics of LTI system in terms of Impulse Response and ROC of its transfer function with suitable examples. [4]

5. Plot the pole-zero in z-plane and Draw Magnitude Response (not to the scale) of the system described by difference equation. [2+4]

$$y[n] - 0.4y[n-1] + 0.1y[n-2] = x[n] + 0.6x[n-1]$$

6. Determine the Direct Form I and Direct Form II realization of the following system. [5]

$$y(n) = -0.1y(n-1) + 0.2y(n-2) + 3x(n) + 3.6x(n-2) + 0.6x(n-2)$$

7. Compute the lattice coefficients and draw the lattice structure of following FIR system. [5]

$$H(z) = 1 + 2z^{-1} + z^{-2}$$

8. Describe how digital FIR filter can be design by window method. Why Kaiser window is better than other fixed windows in FIR filter design? [5+3]

9. What is an optimum filter? Show mathematical expression of Remez exchange algorithm for FIR filter design. [1+6]

10. Explain about the advantages of selecting bilinear transformation method over impulse invariance method (I I M). Design a digital low pass Butterworth filter using impluse invariant transformation with pass band and stop band frequencies 200Hz and 500Hz respectively. The pass band and stop band attenuation are -5dB and -12dB respectively. The sampling frequency is 5kHz. Use IIM method. [3+12]

11. Find the FFT of the signal x[n]{1,1,2,4,3,1,2,1} using DIT-FFT algorithm. [8]

12. Compute Circular Convolution of h(n) = {1, 2, 1, -1, 1} and x[n] = {1, 2, 3, 1}. [7]

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Subject: - Digital Signal Analysis and Processing (CT704)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Define energy and power signal. Check the signal $x[n] = u[n]$ and $x[n] = \delta[n]$ is Energy or Power type. [2+3]

2. Find the output of LTI system having impulse response $h[n] = (1/3)^n \{u[n+1]-u[n-2]\}$ and input signal $x[n] = \{2,1,0.5,3\}$. [5]

3. State the properties of region of convergence (ROC). Drive the convolution property of Z-transform. [3+3]

4. Find the output of LTI System having impulse response $h[n] = (1/2)^n u[n]$ and input signal $x[n] = 5e^{j\pi n/3}$ for $-\infty < n < \infty$. [4]

5. Plot Magnitude Response (not to the scale) of the system described by difference equation. [6]

   $y[n]-0.5y[n-1]+0.3y[n-2] = x[n]+0.7x[n-1]$

6. Determine the Direct Form II realization of the following system [4]

   $y(n) = -0.1y(n-1)+0.72y(n-2)+0.7x(n)-0.252x(n-2)$

7. Compute the lattice coefficients and draw the lattice structure of following FIR system [6]

   $H(z) = 1+2z^{-1}-3z^{-2}+4z^{-3}$

8. Draw the flowchart of Remez-Exchange theorem and explain it. Design an FIR linear phase filter using Kaiser window to meet the following specifications: [6+8]

   $0.99 \leq |H(e^{jw})| \leq 1.01, \text{for } 0 \geq w \geq 0.19\pi$

   $|H(e^{jw})| \leq 0.01, \text{for } 0.21\pi \leq w \leq \pi$

9. Design a low pass digital filter by Bilinear Transformation method to an approximate Butterworth filter, if passband edge frequency is $0.25\ \pi$ radians and maximum deviation of 1 dB below 0 dB gain in the passband. The maximum gain of -15 dB and frequency is $0.45\ \pi$ radians in stopband, Consider sampling frequency 1Hz. [15]

10. Find 8-point DFT of sequence $x[n] = \{1,1,0,1,0,1,2\}$ using Decimation in Time Fast Fourier Transform (DITFFT) algorithm. [7]

11. Why we need DFT? If $X_1(k)$ and $X_2(k)$ are DFT of sequence $x_1[n] = \{1,2,4\}$ and $x_2[n] = \{-1,2,3,1\}$ respectively, then find the sequence $x_3[n]$, if DFT of $x_3[n]$ is given by $X_3(k) = X_1(k) X_2(k)$. [2+6]

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INSTITUTE OF ENGINEERING
Examination Control Division
2071 Chaitra

Exam.			
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Digital Signal Analysis and Processing *(CT704)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Find the even and odd part of signal $x[n]$. [3]

$$x[n] = \begin{cases} 1 & \text{for } -4 \leq n \leq 0 \\ 2 & \text{for } 1 \leq n \leq 4 \end{cases}$$

2. A discrete time LTI system has impulse response $h(n) = \{1,3,2,-1,1\}$ for $-1 \leq n \leq 3$. Determine the system output $y(n)$ if the input $x(n)$ is given by $x(n) = 2\delta(n) - \delta(n-1)$. [6]

3. Define ROC. Find inverse Z-transform of [1+5]

    $X(z) = 1/\{(z-0.5)(z+2)\}$, if
    i)   ROC: $0.5 < |z| < 2$
    ii)   ROC: $|z| < 0.5$
    iii)   ROC: $|z| > 2$

4. The poles of a system are located at: $0.45+0.77i$ and $-2 \pm 0.3i$ and zeroes at: $1.2 \pm 3i$. Map the poles and zero in the z-plane and plot the magnitude response of the system. [2+8]

5. Compute Lattice coefficients and draw lattice structure for given IIR system $H(z) = 1/(1-0.01z^{-1} - 0.23z^{-2}+0.5z^{-3})$. Also check the stability of given system. [4+2+1]

6. What is limit cycle effect in recursive system? Describe with one example showing how it occurs. [3]

7. Design a low pass FIR filter having Pass band edge frequency $\omega_p = 0.3\pi$, Stop band edge frequency $\omega_s = 0.5\pi$ and Stop band attenuation $\alpha_s = 40$ dB using any appropriate window function. [8]

8. What is optimum filter? Show mathematical expression of Remez exchange algorithm for FIR filter design. [1+6]

9. What is the advantage of bilinear transformation? Design a low pass discrete time Butterworth filter applying bilinear transformation having specifications as follows: [2+9+4]
   Pass band frequency $(w_p) = 0.25 \pi$ radians
   Stop band frequency $(w_s) = 0.55 \pi$ radians
   Pass band ripple $(\delta_p) = 0.11$
   and stop band ripple $(\delta_s) = 0.21$
   Consider sampling frequency 0.5 Hz.

   Also, convert the obtained digital low-pass filter to high-pass filter with new pass band frequency $(w'_p) = 0.45 \pi$ using digital domain transformation.

10. Why do we need Discrete Fourier Transform (DFT) although we have Discrete-time Fourier Transform (DTFT)? Find circular convolution between $x[n] = \{1, 2\}$ and $y[n] = u[n] - u[n-4]$. [2+5]

11. How fast is FFT? Draw the butterfly diagram and compute the value of $X(7)$ using 8 pt DIT-FFT for the following sequences: [2+6]
 $x(n) = \{1, 0, 0, 0, 0, 0, 0, 0\}$

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Exam.	**New Back (2066 & Later Batch)**		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Digital Signal Analysis and Processing (CT704)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Find the odd and even part of the following signal: [4+5]
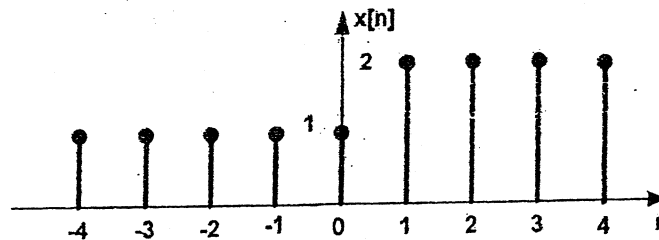
   A discrete time LTI system has input signal and impulse response as,

   $x[n] = \begin{cases} 1 & -1 \le n \le 1 \\ 0 & elsewhere \end{cases}$ and $h[n] = \begin{cases} 1 & -1 \le n \le 1 \\ 0 & elsewhere \end{cases}$ Find the output of the system using graphical method,

2. Find the inverse z transform of: [6]

   $X(Z) = (1+2z^{-1}+z^{-2})/(1+1.5z^{-1}+0.5z^{-2})$, $|z| > 1$

   using partial fraction method.

3. Why do we need difference equation? State linear constant coefficient difference equation and corresponding system function.   [2+3+5]
   Consider an LTI system with impulse response $h[n]=(1/2)^n u[n]$. Determine $y[n]$, if the input is $x[n] = Ae^{in\pi}$

4. If a 3 stage lattice filter for all pole polynomial has coefficients.   [5]

   $K_1 = \frac{1}{4}, K_2 = \frac{1}{2}$ and $K_3 = \frac{1}{3}$ Obtain the system function of this filter.

5. What is the importance of quantization in Digital Signal Processing? Which one is better rounding or truncation? Explain about limit cycles in recursive system? Define dead band.   [1+1+2+1]

6. Explain in detail about how rectangular window is used in FIR filter design. How Gibb's oscillations arise in this process.   [6]

7. What is a Remez exchange algorithm? Derive its equation and draw its flow chart.   [9]

8. Design a low pass digital filter by Bilinear Transformation method to an approximate Butter worth filter it passband frequency is 0.2π radians and maximum deviation of 1 db below 0 dB gain in the pass band. The maximum gain of -15 db and frequency is 0.4π radians in stop band, consider sampling frequency 1 Hz.   [15]

9. A system has input signal $x[n] = \{1,2,3,4\}$ and impulse response $h[n] = \{1,3,5,7\}$ and the DFT of $x[n]$ is $X[k]$ and the DFT of $h[n]$ is $H[k]$. Find the output of the system $y[n]$ if $G[k] = X[k].H[k]$ [7]

10. Find DFT for $\{1, 1, 2, 0, 1, 2, 0, 1\}$ using FFT DIT butterfly algorithm and plot the spectrum.   [6+2]

INSTITUTE OF ENGINEERING
Examination Control Division
2070 Chaitra

Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Digital Signal Analysis and Processing (CT704)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Determine which of the following signals are periodic and compute their fundamental period: [3]
   i) $\cos(\pi n^2/8)$
   ii) $\cos(n/2)\cos(\pi n/4)$

2. Find output, $y(n)$ when: $h(n) = \{5,4,3,2\}$ and $x(n) = \{1,0,3,2\}$ [6]

3. List out the properties of Region of Convergence. Find the Z-transform and locate the ROC of the signal. [2+4]

$$x[n] = \left(-\frac{1}{3}\right)^n u[n] - \left(\frac{1}{3}\right)^n u[-n-1]$$

4. Find the output of LTI System having impulse response [4]
   $h[n] = (1/3)^n u[n]$ and input signal $x[n] = 5e^{j\pi n/2}$ for $-\infty < n < \infty$.

5. Plot Magnitude Response (not to the scale) of the system described by difference equation. $y[n] - 0.3\,y[n-1] + 0.225y[n-2] = x[n] + 0.5x[n-1]$ [6]

6. Determine the Cascade Form realization of the following system. [4]

$$y[n] - \frac{3}{4}y[n-1] + \frac{1}{8}y[n-2] - x[n] - 2x[n-1] = 0$$

7. Compute the lattice coefficients and draw the lattice structure of following FIR system [6]
   $H(z) = 1 + 3.1z^{-1} + 5.5z^{-2} + 4.2z^{-3} + 2.3z^{-4}$

8. Describe how FIR filter can be designed by window method. Discuss the characteristics of different type of window function. [4+4]

9. What is an optimum filter? Show mathematical expression of Remez exchange algorithm for FIR filter design. [1+6]

10. Using bilinear transformation method, design a digital filter using Butterworth approximation which satisfiers the following conditions: [10]

$$0.8 \le |He^{jw}| \le 1 \qquad \text{for } 0 \le w \le 0.2\pi$$

$$|He^{jw}| \le 0.2 \qquad \text{for } 0.6\pi \le w \le \pi$$

11. A digital LPF with cut off frequency $w_c = 0.2575\,\pi$ is given as $H(Z) = \dfrac{0.1 + 0.4z^{-1}}{1 - 0.6z^{-1} + 0.1z^{-2}}$ [5]

    Design a digital high pass filter with $w'_c = 0.3567\pi$.

12. Define Padding zones. Find 8-point DFT of sequence. [1+6]
    $x[n] = \{1,1,0,0,1,1,2\}$ using Decimation in Time Fast Fourier Transform (DITFFT) algorithm.

13. Why we need DFT? State and prove Circular Convolution property of DFT. [2+2+4]

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Exam.			
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Digital Signal Analysis and Processing (CT704)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ Assume suitable data if necessary.

1. Find the even and odd part of signal x[n].   [3]
$$x[n] = \begin{cases} 1 & \text{for} -4 \le n \le 0 \\ 2 & \text{for } 1 \le n \le 4 \end{cases}$$

2. Illustrate the significance of convolution summation in digital signal analysis. Compute the convolution of the following signals: $h(n) = \{1,0,1\}$ and $x(n) = \{1,-2,-2,3,4\}$ [2+4]

3. Define Region of Convergence. Find inverse Z - transform of
$X(z) = z/\{(z-1)(z-2)^2\}$, ROC: $|Z| < 1$ [1+5]

4. Given H(z) for a system with the following difference equation: [2+6+2]
$$y(n) = x(n) + x(n-2)$$
Plot its poles and zeros in Z plane. Determine its magnitude response. Also, determine whether system is causal and stable.

5. Draw lattice structure for given pole - zero system   [6]
$H(z) = (0.5 + 2z^{-1} + 0.6z^{-2})/(1 - 0.3z^{-1} + 0.4z^{-2})$

6. What do you mean by Limit Cycle? How it occurs in recursive system?   [1+3]

7. What is the condition satisfied by Linear phase FIR filter? Show that the filter with $h(n) = \{-1,0,1\}$ is a linear phase filter.   [2+4]

8. Use Hanning window method to design a digital low-pass FIR filter with pass-band edge frequency $(w_p) = 0.25\pi$, stop-band edge frequency $(w_s) = 0.35\pi$ where main lobe width of Hanning window is $8\pi/M$, M is the filter length.   [9]

9. Why Spectral Transformation is required?   [2]

10. Design a low pass digital filter by impulse invariance method to an approximate Butterworth filter, if passband edge frequency is 0.2 π radians and maximum deviation of 0.5 dB below 0 dB gain in the passband. The maximum gain of -15 dB and frequency is 0.35 π radian in stopband, consider sampling frequency 1Hz.   [13]

11. Why do we need Discrete Fourier Transform (DFT) although we have Discrete-time Fourier Transform (DTFT)? Find circular convolution between   [2+5]
$x[n] = \{1,2\}$ and $y[n] = u[n] - u[n-4]$.

12. How fast is FFT? Draw the butterfly diagram and compute the value of x(7) using 8 pt DIT-FFT for the following sequences: [2+6]
$x(n) = \{1,0,0,0,0,0,0,0\}$

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Digital Signal Analysis and Processing (CT704)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt All questions.
✓ The figures in the margin indicate Full Marks.
✓ Assume suitable data if necessary.

1. Define Energy and Power type signal with suitable example. Check the signal $x[n] = Cos(2n\pi/5) + Sin(\pi n/3)$ is periodic or not. [2+2]

2. Define LTI system. Find the output of LTI system having impulse response $h[n] = 2u[n] - 2u[n-4]$ and input signal $x[n] = (1/3)^n u[n]$. [1+4]

3. State the properties of region of convergence (ROC)? Derive the time shifting property of Z-transform. [3+3]

4. Why do we need Difference Equation? Draw Pole-zero in Z-Plane and plot magnitude response (not to the scale) of the system described by difference equation [2+2+6]
$y[n] - 0.4 y[n-1] + 0.2y[n-2] = x[n] + 0.1x[n-1] - 0.06x[n-2]$

5. Determine the Direct Form II realization of the following system [4]
$y(n) = -0.1y(n-1) + 0.72y(n-2) + 0.7x(n) - 0.252x(n-2)$

6. Compute the lattice coefficients and draw the lattice structure of following FIR system [6]
$H(z) = 1 + 2z^{-1} - 3z^{-2} + 4z^{-3}$

7. Design a digital FIR filter for the design of the low pass filter having $\omega_p = 0.3\pi$, $\omega_s = 0.5\pi$, $\alpha_s = 40$ dB using suitable window function. [8]

8. What is optimum filter? Describe Remez exchange algorithm for FIR filter design with flow chart. [1+6]

9. What is the advantage of bilinear transformation? Design a low pass discrete time Butterworth filter applying bilinear transformation having specifications as follows: [2+9+4]

    Pass band frequency $(w_p) = 0.25\pi$ radians
    Stop band frequency $(w_s) = 0.55\pi$ radians
    Pass band ripple $(\delta_p) = 0.11$
    And stop band ripple $(\delta_s) = 0.21$

    Consider sampling frequency 0.5Hz

    Also, convert the obtained digital low-pass filter to high-pass filter with new pass band frequency $(w'_p) = 0.45\pi$ using digital domain transformation.

10. Why do we need FFT? Find 8-point DFT of sequence $x[n] = \{1,1,2,2,1,1,2,1\}$ using Decimation in frequency FFT (DIFFT) algorithm. [2+7]

11. Find $x_3[n]$ if DFT of $x_3[n]$ is given by $X_3(k) = X_1(k) X_2(k)$ where $X_1(k)$ and $X_2(k)$ are 4-point DFT of $x_1[n] = \{1,2,-2\}$ and $x_2[n] = \{1,2,3,-1\}$ respectively. [6]

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INSTITUTE OF ENGINEERING
Examination Control Division.
2069 Bhadra

Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Digital Signal Analysis and Processing (EG774CT)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt All questions.
✓ The figures in the margin indicate Full Marks.
✓ Assume suitable data if necessary.

1. Plot the sequence $x[n] = u[n + 8] - u[n - 4]$. [3]

2. What is the period of following signals? [4]
   (a) $x[n] = \cos\left(\frac{11\pi}{3}n\right)$
   (b) $x[n] = e^{j\frac{7}{5}n}$

3. What is a sampling? How are the spectrum of continuous time signal and the spectrum of signal obtained by sampling the continuous time signal related? Illustrate with diagram. [6]

4. Write about the following properties of discrete time system: [5]
   [a] linearity, [b] time invariance, [c] memory, [d] causality [e] stability.

5. Find the frequency response $H(e^{j\omega})$ of the system characterized by difference equation $y[n] - 0.8\, y[n-1] + 0.15\, y[n-2] - x[n] = 0$. Plot the frequency response of the system. [6]

6. Realize the system function
$$H(z) = \frac{1}{(1 - 0.5z^{-1})\left(1 - 0.7e^{-j\frac{\pi}{4}}z^{-1}\right)\left(1 - 0.7e^{j\frac{\pi}{4}}z^{-1}\right)(1 - 0.3z^{-1})}$$
in terms of cascade of second order sections. Draw the block diagram of the cascade realization. [6]

7. Write about the sign magnitude and 2's complement representation of binary fractional number. Write about truncation error and rounding error. [6]

8. Describe digital Butterworth filter design using impulse invariance technique. What are the limitations of impulse invariance technique? [15]

9. Derive the expression for frequency response of symmetric linear phase filter of length M, where M is odd. [6]

10. Use the Hanning window to design a digital low-pass FIR filter with Pass band frequency $(\omega_p) = 0.25\pi$ and Stop band frequency $(\omega_s) = 0.3\pi$. [8]

11. Perform circular convolution of the sequences $x[n] = [1\ 0\ 1]$ and $h[n] = [1\ 0\ 2\ 1]$. [5]

12. Write about multiplication and convolution property of Discrete Fourier Transform. [6]

13. Draw the flow diagram of four point decimation in time Fast Fourier Transform algorithm. [4]

* * *

Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Digital Signal Analysis and Processing

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt All questions.
✓ The figures in the margin indicate Full Marks.
✓ Assume suitable data if necessary.

1. Find the energy and power of the signal $x[n] = u[n]$. [5]

2. Find the period of the signal $x[n] = \sum_{m=-\infty}^{\infty} \delta[n - 2 - 3m]$. Find the Fourier series coefficients of the signal $x[n]$. [6]

3. State whether or not the system $y[n] = e^{x(2n)}$ is (a) linear (b) time invariant (c) memoryless (d) causal. Where $x[n]$ is input to system and $y[n]$ is output of system. [5]

4. Convolve the sequences $x[n] = 3^n u[-n - 5]$ and $y[n] = u[n - 5]$. [5]

5. Find the frequency response of the linear time invariant system characterized by difference equation $y[n] - \dfrac{10}{24}y[n-1] + \dfrac{1}{24}y[n-2] = x[n]$. If input to the system is $x[n] = \sin\left(\dfrac{\pi}{3}n\right) + \sin\left(\dfrac{\pi}{5}n\right)$ then determine output $y[n]$ of the system. [7]

6. Realize the overall system function: [9]

$$H(z) = \frac{(1 - \frac{1}{5}e^{-j\frac{\pi}{5}}z^{-1})(1 - \frac{1}{3}z^{-1})(1 - \frac{1}{5}e^{j\frac{\pi}{5}}z^{-1})}{(1 - \frac{4}{5}z^{-1})(1 - \frac{1}{7}e^{j\frac{\pi}{7}}z^{-1})(1 - \frac{1}{5}z^{-1})(1 - \frac{1}{7}e^{-j\frac{\pi}{7}}z^{-1})}$$

In terms of direct from I and direct from II structures. Draw the corresponding block diagrams of direct from I and direct from II structures.

7. How the spectrum of continuous time signal is related to spectrum of corresponding discrete time signal obtained by sampling the continuous time signal? Explain. Discuss what is aliasing and how it occurs. [8]

8. If passband edge frequency $\omega_p = 0.25\pi$, stopband edge frequency $\omega_s = 0.45\pi$, passband ripple $\delta_p = 0.17$ and stopband ripple $\delta_p = 0.27$ then design a digital lowpass Butterworth filter using bilinear transformation technique. [18]

9. Use Blackman window method to design a digital low-pass FIR filter with passband edge frequency $\omega_p = 0.24\pi$, stopband edge frequency $\omega_s = 0.34\pi$ where main lobe width of Blackman window is $\dfrac{12\pi}{M}$, M is filter length. [9]

10. Use the Fast Fourier Transform decimation in frequency algorithm to find the discrete Fourier Transform of the sequence $x[n] = [1 -2\ 2\ 1]$. [8]

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Examination Control Division
2079 Baishakh

Exam.		Back	
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Aeronautical Telecommunication *(Elective I) (EX72504)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. What do you mean by Air Traffic Management (ATM) and why it is necessary? Describe in brief about the types of ATC. [2+2+4]

2. Describe different organizations involved in aviation field. Explain role of ICAO in civil aviation. [4+4]

3. Explain in brief the working principle of NDB. Also discuss the limitations of NDB. [3+5]

4. Describe VHF omnidirectional range VOR as a navigational aid with basic working principle. Why Doppler VOR is more pronounced than Conventional VOR? [6+2]

5. Describe the general principle of DME transponder with block diagram. List different types of errors associated with DME and explain how it can be minimized. [4+4]

6. Explain how Localizers and Marker Beacons guide an aircraft to the centerline of the runway. [6+2]

7. Derive the free space RADAR equation. Explain operation of secondary surveillance RADAR with its coding principle. [8]

8. What should be the minimum receiver sensitivity of the primary antenna to detect a target at 60 Nautical Miles from station while power meter shows 1.6 kW at operating frequency of 2.7 GHz? It assumed that antenna gain of the RADAR is 48 dB with waveguide loss of 6 dB. Assume standard echoing area = 15 m^2. [8]

9. How GPS helps to determine position of an aircraft? Write briefly about INMERSAT satellite. [3+5]

10. Write short notes on focusing on function of: [2×4]
   a) ADF
   b) GLONASS

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TRIBHUVAN UNIVERSITY
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2076 Chaitra

Exam.		Regular	
Level	BE	**Full Marks**	80
Programme	BEX, BCT	**Pass Marks**	32
Year / Part	IV / I	**Time**	3 hrs.

Subject: - Aeronautical Telecommunication *(Elective I)(EX 72504)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ Assume suitable data if necessary.

1. Describe the different type of communication systems used in ground to ground and air to ground communication in aviation based air traffic management. [8]

2. Describe different organizations involved in aviation field. Mention role of ICAO in civil aviation. [4+4]

3. Describe the working principle of NDB. What is the limitation of NDB? [4+4]

4. How VOR is different than NDB? What is the siting requirement of VOR? [4+4]

5. Discuss the importance of squitter pulses in DME. Describe different types of errors and echo in DME and how its effect can be minimized? [3+5]

6. Discuss transmission techniques of Localizer system of ILS and also mention type of its antenna system. [8]

7. What should be the minimum receiver sensitivity of a primary antenna to detect a target at 60NM from station while power meter shows 1.6kw at operating frequency 2.74 GHz. It is assumed that gain is 48dB and wave guide loss is 6dB. Standard echoing area $= 15m^2$ [8]

8. Describe the principal of operation of Primary and Secondary RADAR. What are other means of survellance in civil aviation? [5+3]

9. Describe the working principal of Global Positioning system (GPS) with suitable diagram. How GPS can be used in Aviation? [8+2]

10. Write about ADF and its component. [6]

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Subject: - Aeronautical Telecommunication *(Elective I) (EX72504)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ __All__ questions carry equal marks.
✓ Assume suitable data if necessary.

1. a) What different type of communication systems are used in aviation for the efficient Air Traffic Management?

   b) What is ICAO? Explain its role in Civil Aviation.

2. a) What are the problems that a pilot might face if he is using the NDB as a primary navigational aid?

   b) Explain briefly how aircraft extracts the Azimuth Information with the help of VOR receiver.

3. a) Explain the working principle of a DME with a suitable block diagram.

   b) What is ILS and how it helps the aircraft to land in a poor visibility condition.

4. a) Derive the free space radar equation and explain clearly on the basis of this equation how the maximum range can be achieved.

   b) Describe the working principle of Secondary Surveillance Radar (SSR) in your own words?

5. a) What is GNSS and how it helps the aircraft for Navigation?

   b) What are the functions of CVR and FDR in an Aircraft?

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Aeronautical Telecommunication *(Elective I) (EX72504)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. What are the types of ATC? What do you mean by ATM? Why is it necessary?   [4+1+2]

2. Write about the frequency bands used in Aviation. Describe how HF ground to ground communication works.   [4+4]

3. What are the factors affecting output of loop aerial antenna? Show mathematically what are the uses of NDB? Discuss its drawbacks.   [4+2+4]

4. List out merits of DVOR over CVOR. Explain the reference signal generation in DVOR with neat and properly labelled diagram.   [4+6]

5. With figure, explain how DNE transponder operates. How is error caused by echo pulses eliminated in DME?   [5+4]

6. Explain how localizer guides an aircraft to the centerline of the runway.   [6]

7. Write about principle of operation of secondary radar with its coding system.   [5]

8. Explain the working of primary radar with its block diagram.   [5]

9. How does GPS determine position of an aircraft?   [4]

10. Discuss the components of ADF (Automatic Direction Finder) in brief.   [4]

11. Write short notes on: (any four)   [4×3]

    i) GILNASS vs. GPS
    ii) Marker becomes in ILS
    iii) Piloting and dead reckoing
    iv) FDR and CVR
    v) Automatic dependence serveillance

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Exam.		Back	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Aeronautical Telecommunication *(Elective I)* (EX72504)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. What is an AFTN? What are the different message categories in AFTN? Explain in brief the message format of AFTN message with proper example. [8]

2. Explain in brief the working principle of NDB. Also discuss the impact of top loading in NDB antenna. [8]

3. Differentiate between Conventional and Doppler VOR. What are possible VOR errors? Explain each of them in brief. [8]

4. How distance measurement is achieved using DME? Explain in detail. [8]

5. Discuss the basic operation of Glide slope with a diagram. Also mention the uses of different type of Glide slope. [8]

6. What should be the minimum receiver sensitivity of primary antenna to detect a target at 60 NM from station while power meter shows 1.6 KW at operating frequency 2.7 GHz. It is assumed antenna gain of radar is 48dB with waveguide loss of 6 dB? [8]

7. Derive the radar range equation. Why transmitted power is different for same coverage in ASR and SSR? [8]

8. Explain the working principle of Automatic direction finder with proper diagrams. [8]

9. Write short notes on: [4×4]
   i)   History of aviation
   ii) Air traffic control
   iii) International maritime satellite system
   iv) GLONASS

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Subject: - Aeronautical Telecommunication *(Elective I) (EX72504)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ *Attempt All questions.*
✓ *All questions carry equal marks.*
✓ *Assume suitable data if necessary.*

1. a) Explain briefly how Air Traffic Control takes place in an International airport.

   b) What is ICAO? Explain its importance and functions in civil aviation.

2. a) Explain briefly how aircraft finds direction with help of ADF receiver?

   b) Why DVOR is preferred over CVOR explain briefly?

3. a) Explain the working principle of a DME with a suitable block diagram.

   b) How ILS helps the pilots to land the aircraft in a poor visibility?

4. a) With a suitable block diagram explain the working principle of a Primary Surveillance Radar.

   b) In your opinion what are the advantages of Secondary Radar (SSR) over Primary Radar (ASR)?

5. a) What is GNSS? Describe briefly in our own words.

   b) What is Flight Data Recorder? Explain its function briefly.

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TRIBHUVAN UNIVERSITY
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Examination Control Division
2079 Baishakh

Exam.		Back		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Web Technologies and Applications *(Elective I) (CT72505)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ Assume suitable data if necessary.

1. Write brief history of internet and WWW. [5]

2. Design a HTML form containing text box for First Name, Last Name, Phone No, radio button for gender and checkbox for hobbies. [5]

3. What are different types of CSS and how they can be used with HTML document? [5]

4. What is Java servlet technology? What are the advantages of Java servlet over CGI? [2+4]

5. Describe the concept of multi-tier architecture with reference to web technology. [6]

6. What is Document Object Model (DOM)? Explain different document object methods to access and change the contents of HTML document. [1+5]

7. What are the key benefits of using MVC (model-View-Controller)? How MVC works? Explain. [6]

8. What is the purpose of CMS (Content Management System)? How CMS is different from web application framework? [2+3]

9. Explain the concept of web 2.0. What are the major changes in web 3.0 over web 2.0? Explain with example. [3+3]

10. Explain how AJAX request and response method works. [5]

11. Design a well formatted XML document and DTD for your XML document "MyEmployeeList" which has fields and data as given in table below. "MyEmployeeList" have data myEmployee and myEmployee consist name, contact and address, in employee list some employees are considered to be bestEmployee. [10]

my Employee			
Name			Address
First Name	Last Name		
Chhitz	Devkota	9831000101	Jumla
Narmada	Gaudel	9831000102	Humla
bestEmployee			
Balkrishna	Rokaya	9831000103	Parbat

12. Define service-oriented architecture. Describe HTTP methods that are supported by REST architectural style for communication between client and server application. [1+5]

13. What is sematic web and what is its purpose? What are the roles of RDF and OWL in semantic web? Explain with example. [3+6]

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Examination Control Division
2078 Bhadra

Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Web Technologies and Applications *(Elective I)(CT 72505)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ Assume suitable data if necessary.

1. What is Internet and Web? Explain the importance of Web Technology. [4+4]

2. Design HTML User Registration form as below. Validate the registration form using JavaScript. [10]

> **User Registration Form**
> Name [   ]
> Email [   ]
> Gender O Male O Female
> Phone [   ]
> Country [select ▽]
> Description
> [   ]
> [   ]
> [Registration]

3. What do you mean by Server side processing? Explain Multitier architecture? [4+4]

4. Explain Dialogue Boxes in JavaScript? [6]

5. What is Content Management system? Explain Web application framework. [3+5]

6. Differentiate Web 2.0 and Web 3.0? Why Tagging-folksonomies are important? [4+4]

7. Define XML and XSLT. Explain with appropriate example. [10]

8. Explain Service Oriented Architecture (SOA). Differentiate SOAP and REST? [6+4]

9. What is semantic web? Explain the purpose of semantic web with suitable example. [6]

10. Write short notes on: (Any Two) [2×3]

    a) Crawling
    b) AJAX
    c) DOM
    d) RDF

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INSTITUTE OF ENGINEERING

Examination Control Division

2074 Ashwin

Exam.		Back	
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Web Technologies and Applications *(Elective I) (CT72505)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Define XML? Design well formed XML document for "Student". Student should have data such as Name, Address, Phone and Email. Name should contain FirstName and LastName. Also write the DTD (Document Type Definition) for your XML document. [2+8]

2. Design a HTML User Registration form as below. [10]

   User Registration Form

   Name

   Email

   Gender   ○ Male ○ Female

   Phone

   Interest

   Register

   Validate the registration form using JavaScript. Validation should be as:

   i.   All fields are compulsory.
   ii. Name should be all characters
   iii. Phone should be all numbers
   iv. Validate email format
   v.   Interest should be in between 20 to 1000 characters.

3. How internet evolved? Explain the importance of web technology. [4+4]

4. What is Document Object Model (DOM)? Explain on the basis of HTML/Java Script. [6]

5. Define web architecture with its importance. Explain the components of web-tier architecture. [2+2+4]

6. What do you mean by client-side and server side processing? Explain with example. [7]

7. Define Web 2.0? Explain Web 2.0 tools Blogging and Social Networking. [2+6]

8. What is MVC (Model-View-Controller)? Explain the need and use of MVC in web application framework. [2+6]

9. What is semantic web? Explain the purpose of semantic web with suitable example. [6]

10. Write short notes: (Any three) [3×3]

    a) SOAP (Simple Object Access Protocol)
    b) AJAX (Asynchronous JavaScript and XML)
    c) REST (Representational State Transfer)
    d) FTP (File Transfer Protocol)

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Subject: - Data Mining (Elective I) (CT72502)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt All questions.
✓ The figures in the margin indicate Full Marks.
✓ Assume suitable data if necessary.

1. Describe the process of knowledge discovery in databases. Explain the specific challenges that motivated the development of data mining. [3+3]

2. Suppose that the data for analysis include the attribute the frequency of stop words in documents. The values are given in increasing order: 13, 15, 16, 16, 19, 20, 20, 21, 22, 22, 25, 25, 25, 25, 30, 33, 33, 35, 35, 35, 35, 36, 40, 45, 46, 52, 70. [6]

   a) Use smoothing by bin means with a depth of 3.
   b) Use min-max normalization to transform the value 35 into the range from 0.0 to 1.0.
   c) Use z-score normalization to transform the value 35 where the standard deviation of the above frequency is 12.94.
   d) Use normalization by decimal scaling to transform the value 35.

3. What are nominal and ordinal attributes? Discuss how to handle missing data and noisy data during data cleaning process. [6]

4. Describe the working mechanism as well as the merits and demerits of the holdout method, random sampling, k-cross validation and bootstrap approaches in evaluating the performance of a classifier. [8]

5. a) Write Apriori algorithm and using the algorithm find all the frequent itemset for the following database. (min_sup = 20%). [5]

TID	A1	A2	A3	A4	A5	A6	A7	AB	A9
T2	0	1	0	1	0	0	0	1	0
T3	0	0	0	1	1	0	1	0	0
T4	0	0	1	0	0	0	0	0	0
T5	0	0	0	0	1	1	1	0	0
T6	0	1	1	1	0	0	0	0	0
T7	0	1	0	0	0	1	1	0	1
T8	0	0	0	0	1	0	0	0	0

   b) Is it possible to generate any rules out of the frequent items, considering any value of confidence threshold? [3]

6. Given the following confusion matrix, determine Accuracy, Error rate, Sensitivity, Specificity, Precision, Recall of the classifier model. [4]

n = 165	Predicted: NO	Predicted: YES	
Actual: NO	TN = 50	FP = 10	60
Actual: YES	FN = 5	TP = 100	105
	55	110	

7. How does FP growth approach generate frequent item sets without generating candidate item sets? Explain with an example. [6]

8. Define clustering. Given the matrix whose column represent different data points, perform a K-means clustering on this dataset using the Manhattan as the distance function. The center of the 3 clusters are initiated as A(6.2, 3.2), B(6.6, 3.7) and C(6.5, 3.0). Provide the final cluster centers after 3 iteration. [8]

5.9	4.6	6.2	4.7	5.5	5.0	4.9	6.7	5.1	6.0
3.2	2.9	2.8	3.2	4.2	3.0	3.1	3.1	3.8	3.0

9. Explain hierarchical clustering method with an example of Dendogram plot. [6]

10. Describe the strengths and weaknesses of the statistical, proximity-based, density-based and cluster-based approaches of anomaly detection. [6]

11. Write short notes on: [4×4]

   a) Time Series data mining
   b) Web mining
   c) Data visualization
   d) DBSCAN clustering

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Bhadra

Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Data Mining (Elective I)(CT 72502)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Explain how data mining system can be integrated with database/data warehouse system. Explain Data mining process with diagram. [4+2]

2. Suppose that a data warehouse consists of the four dimensions data, spectator, location, and game, and the two measures count and charge, where charge is the fare that a spectator pays when watching a game on a given date. Spectators may be students, adults or seniors, with each category having its own charge rate. [3+3]

   a) Draw a star schema diagram for the data warehouse.
   b) Starting with the base cuboid [data, spectator, location, game], what specific OLAP operations should you perform in order to list the total charge paid by student spectators at Dashrath Stadium in 2021?

3. Use the following methods to normalize the data: 200, 300, 400, 600 and 1000. [2+2+2]

   a) Min-max normalization by setting min=0 and max=1
   b) Z-score normalization
   c) Normalization by decimal scaling

4. Construct a decision tree for the following data set using information gain. Predict the class label for a data point with values<Female, 2, standard, high> [8]

Gender	Car ownership	Travel cost	Income level	Transport mode
Male	0	Cheap	Low	Bus
Male	1	Cheap	Medium	Bus
Female	0	Cheap	Low	Bus
Male	1	Cheap	Medium	Bus
Female	1	Expensive	High	Car
Male	2	Expensive	Medium	Car
Female	2	Expensive	High	Car
Female	1	Cheap	Medium	Train
Male	0	Standard	Medium	Train
Female	1	Standard	Medium	Train

5. Consider the given transactional database from a grocery store. Use a support threshold of 33.34% and confidence threshold of 60% to compute the following: [4+4]

   a) Build a frequent pattern tree (FP-Tree). Show for each transaction how the tree evolves.
   b) Use FP-Growth algorithm to discover the frequent itemsets from this FP-tree.

Transcation ID	Items
T1	HotDogs, Buns, Ketchup
T2	HotDogs, Buns
T3	HotDogs, Coke, Chips
T4	Chips, Coke
T5	Chips, Ketchup
T6	HotDogs, Coke, Chips

6. Calculate: Accuracy, TPR, FPR and Precision for the given confusion matrix for a classifier. [4]

		Actual Class	
		Class 1	Class 2
Predicted Class	Class 1	142	40
	Class 2	98	720

7. Explain Naive Baiyesian classification algorithm with suitable example. [6]

8. Write K-means clustering algorithm. Generate two clusters from following dataset using K-means clustering. [2+6]

Instance	A	B
1	1	2
2	2.5	1
3	3.5	1.5
4	4	1
5	3.5	2.5
6	5	3

9. Provide answers to the following with regard to the DBSCAN clustering approach: [2+2+2]

   a) How does the DBSCAN quantify the neighborhood of an object? How is a large dense region assembled from small dense regions centered by core objects?

   b) How does DBSCAN find clusters? How are the neighborhood threshold (Epsilion) and minimum number of points (MinPts) determined empirically in DBSCAN?

   c) Prove that in DBSCAN, for a fixed minimum number of points (MinPts) value and two neighborhood thresholds, Epsilion1 < Epsilion2, a cluster (C) with respect to Epsilion1 and MinPts must be a subset of a subset of a cluster (K) with respect to Epsilion2 and MinPts.

10. Compare and contrast among three difference methods of anomaly detection. [6]

11. Write short notes on: [4×4]

   a) Minkowski Distance
   b) Laplacian Correction in Classification method
   c) Page rank algorithm in Web mining
   d) Overfitting problem in classification

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Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: Data Mining *(Elective I) (CT72502)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ Assume suitable data if necessary.

1. Find the principal components and the proportion of the total variance explained by each when the covariance matrix of the three random variables X_1, X_2, and X_3 is: [4]

$$\Sigma = \begin{bmatrix} 1 & -2 & 0 \\ -2 & 5 & 0 \\ 0 & 0 & 2 \end{bmatrix}$$

2. (a) Given the following points compute the distance matrix using the Manhattan and the Supremum distance. [2+1+2]

Points	X	Y
P1	6	3
P2	2	2
P3	3	4

   (b) Given the following two vectors compute the Cosine similarity between them.
   D1 = [4 0 2 0 1]
   D2 = [2 0 0 2 2]

   (c) Given the following two binary vectors compute the Jaccard similarity and Simple Matching Coefficient.
   P = [0 0 1 1 0 1]
   Q = [1 1 1 1 0 1]

3. Suppose that a data warehouse for a sales company consists of five dimensions: *time*, *location*, *supplier*, *brand*, and *product*, and two measures: *count* and *price*. [3+3]
   (a) Draw a *snowflake schema* diagram for the data warehouse.
   (b) Starting with the base cuboid [*time, location, supplier, brand, product*], what specific OLAP operations should one perform in order to list the total *count* for a certain *brand* for each *state* per *year* (assume *location* has three levels: *country, state, city*; and assume *time* has three levels: *year, month, day*)?

4. Why is a conflict resolution strategy often necessary for rule-based classifiers? Describe the common conflict resolution strategies for rule-based classifiers. [2+4]

5. The following dataset will be used to train a decision tree for predicting whether a mushroom is edible or not based on its shape, color and odor. [2+5]

Shape	Color	Odor	Edible
C	B	1	Yes
D	B	1	Yes
D	W	1	Yes
D	W	2	Yes

C	B	2	Yes
D	B	2	No
D	G	2	No
C	U	2	No
C	B	3	No
D	W	3	No

(a) Which attribute would the ID-3 algorithm choose to use for the root of the decision tree?

(b) Draw the full decision tree that would be learned for the given data.

6. Consider the multi-layer feed-forward neural network shown in the following figure. This neural network has three inputs (x_1), (x_2) and (x_3) connected to a hidden layer consisting of two nodes (h_1) and (h_2). The weight of the edge connecting (x_i) to (h_j) is (w_{ji}). The two hidden nodes are connected to the output node (o). The weight of the edge connecting the hidden node (h_i) to the output node (o) is (u_i). The activation functions at hidden and output layers is set to sigmoid function defined as follows:

[2+3+4]

$$\sigma(\theta) = \frac{1}{1 + exp(-\theta)}$$

Using the target output (t), the squared error is used as the loss function at the output node, and is defined as:

$$E(o,t) = \frac{1}{2}(o - t)^2$$
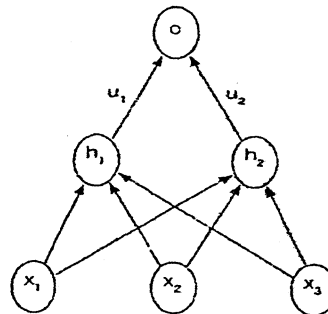
(a) Using the symbols given above, compute the activation at (h_1).

(b) Compute the gradient of the loss with respect to the output (o).

(c) Compute the gradient of the loss with respect to the weight (w_{12}).

7. Consider the transaction data shown in the following table from a fast food restaurant.

[5+3]

Meal Item	List of Item IDs
Order:1	M1, M2, M5
Order:2	M2, M4
Order:3	M2, M3
Order:4	M1, M2, M4
Order:5	M1, M3
Order:6	M2, M3
Order:7	M1, M3

Order:8	M1, M2, M3, M5
Order:9	M1, M2, M3

There are 9 distinct transactions (Order: 1 – Order: 9) and each transaction involves between 2 and 4 meal items. There are a total of 5 meal items that are involved in the transactions. For simplicity, the meal items have been assigned short names (M1-M5). Assume that the minimum support is 2/9 and the minimum confidence is 7/9.

(a) Apply the Apriori algorithm to the dataset of transactions and identify all frequent k-itemsets.

(b) Find all strong association rules of the form: $X \land Y \rightarrow Z$ and note their confidence values.

8. (a) List all the 4-subsequences contained in the data sequence: $< \{1,3\} \{2\} \{2,3\} \{4\} >$

(b) Draw all candidate sub-graphs obtained from joining the pair of graphs shown below using edge-growing method to expand the sub-graphs.
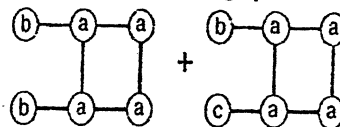
[3+3]

9. Given the matrix (X) whose rows represent different data points, perform a k-means clustering on this dataset using the Euclidean distance as the distance function. Here (K) is chosen as 3. The center of the 3 clusters are initialized as red (6.2, 3.2), green (6.6, 3.7) and blue (6.5, 3.0). Provide the final cluster centers and comment on the number of iterations required for the clusters to converge.

[8]

$$X = \begin{bmatrix} 5.9 & 3.2 \\ 4.6 & 2.9 \\ 6.2 & 2.8 \\ 4.7 & 3.2 \\ 5.5 & 4.2 \\ 5.0 & 3.0 \\ 4.9 & 3.1 \\ 6.7 & 3.1 \\ 5.1 & 3.8 \\ 6.0 & 3.0 \end{bmatrix}$$

10. The table below is a distance matrix for six objects:

[4+4]

	A	B	C	D	E	F
A	0					
B	0.12	0				
C	0.51	0.25	0			
D	0.84	0.16	0.14	0		
E	0.28	0.77	0.70	0.45	0	
F	0.34	0.61	0.93	0.20	0.67	0

(a) Show the final result of hierarchical clustering with single-link by drawing a dendrogram.

(b) Show the final result of hierarchical clustering with complete-link by drawing a dendrogram.

11. (a) Discuss the issues related to anomaly detection. [2]

(b) If the probability that a normal object is classified as an anomaly is 0.01 and the probability that an anomalous object is classified as anomalous is 0.99, then what is the false alarm rate and detection rate if 99% of the objects are normal? [3]

12. Consider the following subset of pages and their links. Apply the PageRank algorithm using a damping factor of 0.85. A minimum of five iterations are required. Assume initial page rank of all pages is 0.25. [8]
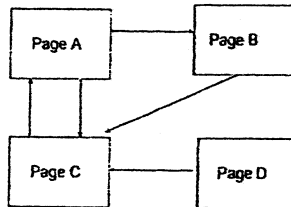
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INSTITUTE OF ENGINEERING
Examination Control Division
2075 Chaitra

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Data Mining *(Elective I) (CT72502)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Explain Data Warehouse architecture with its analytical processing. [8]

2. Why data preprocessing is necessary? Explain the methods for data preprocessing to maintain data quality. [4+4]

3. Define Decision Tree Classifier with Gini-Index with suitable example. How can you handle overfitting in Decision Tree? [6+4]

4. What do you mean by frequent Pattern growth, draw FP-tree with given tabular data. [4+4]

TID	Items
01	f, a, c, d, g, i, m, p
02	a, b, c, f, l, m, o
03	b, f, h, j, o, w
04	b, c, k, s, p
05	A, f, c, e, l, p, m, n

5. How ANN works? Explain with Algorithm. [8]

6. What is the application of clustering in data mining? Explain K-means clustering with example. [2+6]

7. How DBSCAN clustering is used for handling noise in data? [8]

8. What is outlier? Explain the distance base approaches for the anomaly detection. [5]

9. What are the challenges of web mining? Explain about time series data mining with an example. [5]

10. Write short notes on: (Any three) [4+4+4]

    a) Market Basket Analysis
    b) Visual Data Mining
    c) OLAP and OLTP
    d) Data Normalization

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Exam.		Back	
Level	BE	Full Marks	80
Programme	BCT, BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Data Mining (Elective I) (CT72502)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. How is data warehouse different from a database? How are they similar? [2+2]

2. Discuss issues to consider during Data Integration. Describe OLAP and operations on OLAP with suitable example. [5+5]

3. Explain Naïve Bayesian classification with suitable example. [8]

4. The confusion matrix for a classifier is given as follows: [10]

		Predicted Class	
		Class 1	Class 2
Actual Class	Class 1	21	6
	Class 2	7	41

Calculate: Accuracy, Sensitivity, Specificity and Precision.

5. Why association analysis is required in data mining? Explain Apriori principle with example. [2+6]

6. What are the advantages of FP growth method? Explain FP growth algorithm. [2+6]

7. Explain K-means clustering with limitation. Generate two clusters from following dataset using K-means clustering. [4+6]

A	B
1	2
2.5	4.5
4	6
3.5	4
4	5.5
3	6

8. What are outliers? Explain an algorithm that can be used to generate density based clusters. [8]

9. Why anamoly detection is important? Explain distance based method for anamoly detection. [2+6]

10. Explain Web mining and Multimedia mining. [6]

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Exam.		**Back**	
Level	BE	**Full Marks**	80
Programme	BEX, BCT	**Pass Marks**	32
Year / Part	IV / I	**Time**	3 hrs.

Subject: - Data Mining *(Elective I) (CT72502)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. What is data mining? Explain the process of data mining. [2+3]

2. In real-world data, tuples with missing values for same attributes are a common occurrence. Describe various methods for handling this problem. [5]

3. What is classification? Explain Rule-Based classification with its classification principles with suitable example. [2+8]

4. The confusion matrix for a classifier is given as follows: [10]

		Predicted Class	
		Class 1	Class 2
Actual Class	Class 1	25	9
	Class 2	4	31

Calculate:

a) Accuracy b) Sensitivity
c) Specificity d) Precision

5. Identify the candidate, frequent item sets and association rules for the following transaction data using Apriori algorithm. [8]

TID	ITEMS
1	M1, M2, M5
2	M2, M4
3	M2, M3
4	M1, M2, M4
5	M1, M3
6	M2, M3
7	M1, M3
8	M1, M2, M3, M5
9	M1, M2, M3

Take minimum support = 20%, minimum confidence 80%

6. Explain FP-Growth algorithm with example. [8]

7. Write K-means algorithm and find clusters for following data set. [2+8]

Instance	X	Y
1	1.0	2.0
2	2.5	1.0
3	3.5	1.5
4	4.0	1.0
5	3.5	2.5
6	5.0	3.0

(Take K = 2)

8. What is web mining? Explain different categories of web mining. [6]

9. List the various types of partition based clustering methods. Explain Hierarchical clustering method with an example. [10]

10. Write short notes on: (Any two) [2×4]

    a) OLAP Operations
    b) Density reachable and Density Connected
    c) Data Mining for Anomy Detection

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Image Processing and Pattern Recognition *(Elective I) (CT72504)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ Assume suitable data if necessary.

1. Define terms Digital Image and Digital Image Processing. Explain key stages of digital image processing with a block diagram. [2+6]

2. Why Fourier transform is useful in image processing? Describe the Haar transform. [2+6]

3. Explain about Gray Level Slicing. An image has the following histogram, stretch the whole dynamic range using Histogram equalization: [2+6]

Gray Level (r_k)	0	1	2	3	4	5	6	7
Frequency (n_k)	200	300	600	900	200	500	100	800

4. Describe the principle objectives of image enhancement. Explain contrast stretching process and intensity level slicing. [2+6]

5. Explain the different types of data redundacies present in image processing. Construct Huffman code for each grey level given and find the compression ratio and coding efficiency. [2+6]

Grey Level	0	1	2	3	4	5	6	7
No. of Pixels	30	35	38	10	15	10	38	80

6. Write down the applications of Pattern Recognition? Explain the terms features and classifier with examples. Explain about the Nearest Neighbors Classifier. [2+2+4]

7. Define line detection. Explain simple edge detection technique using Gradient filter. [2+6]

8. Explain different types of thresholding used for segmentation process. Write down the algorithm for choosing a global thresholding value in an image. [3+5]

9. Explain frequency domain filtering operation with its block diagram. Explain the butter worth low pass filter along with its transfer function. [3+5]

10. Write short notes on: [4+4]

   i) Neural network and its applications to pattern recognition
   ii) Median filter

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Radar Technology *(Elective I) (EX 72501)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ *Attempt __All__ questions.*
✓ *The figures in the margin indicate __Full Marks__.*
✓ *Assume suitable data if necessary.*

1. What are the basic functions of radar? In indicating the position of a target, what is the difference between azimuth and elevation? Explain the operating principle of Radar. [1+2+2]

2. What are the different range frequencies that primary and secondary radar can operate and give their applications? Explain how the radar is used to measure the direction and position of target? [3+2]

3. Discuss the parameters on which maximum detectable range of a radar system depends? Compute the maximum detectable range of a radar system specified below: [5+5]

   a) Operating wavelength = 3.2cm
   b) Peak pulse transmitted power = 500kW
   c) Minimum detectable power = 10^{-3}W
   d) Capture area of the antenna = 5 sq. m.
   e) Radar cross-sectional area of the target = 20 sq. m.

4. Explain the term peak power, average power & duty cycle, define noise bandwidth of a radar receiver, obtain the expression for minimum detectable signal in terms of noise bandwidth, noise figure and other relevant parameters. [3+4]

5. How doppler frequency shift is utilized in Radar system? What are multiple time around echoes? Explain the relation between unambiguous range estimation and multiple time around echoes. [1+3+3]

6. Discuss the advantages of FMCW radar over CW radar. What is beat frequency? How it is used in FMCW radar to find range? [2+3+3]

7. What are the advantages & limitations of MTI radar? Draw the block diagram of MTI radar and explain its operation. [3+3+2]

8. What is a delay line canceller? Illustrate the concept of blind speeds based on the frequency response of a single delay line canceller. Suggest a method to reduced the effect of blind speeds for unambiguous detection of a moving target. [2+3+1]

9. What is Doppler ambiguity? In an MTI radar the pulse repetition frequency is 200Hz and the carrier transmission frequency are 100 MHz. Find its first, second and third blind speeds. [1+4]

10. What is Tracking Radar? Compare the different types of trackers. Differentiate between MTI radar and Pulse Doppler radar with Block diagram. [1+3+3]

11. Explain the Radar Modulator used in Radar system with neat block diagram. [6]

12. Write short notes on: *(Any Two)* [3×2]

    a) Sequential lobbing
    b) Matched filter receiver
    c) Simple form of the radar equation.

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Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Radar Technology *(Elective I) (EX72501)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Draw the Block diagram of Radar, Explain the operating principle of Radar. What are the applications of Radar? [2+1+2]

2. What is the physical significance of integration of radar pulses. Justify the requirement of integration of radar pulses with an example. [2+6]

3. For the specifications of a radar listed below, Compute the maximum detectable range; Operating wavelength = 3.2 cm, Peak pulse transmitted power = 500 kW, Minimum detectable power = 10^{-13} W, Capture area of the antenna = 5 sq.m, Radar cross-sectional area of the target = 20 sq.m. [8]

4. What are the peak power and duty cycle of radar whose average transmitter power is 500 W, Pulse width of 1 µs and pulse repetition frequency of 880 Hz? [6]

5. What is doppler frequency shift? Imagine positions of the two aircraft, A and B, are as shown in the figure below. Aircraft A has a speed of 600 m/sec and carries a CW radar transmitting at 300 MHz frequency and tracking aircraft B which has a speed of 800 m/sec. [2+3+2]
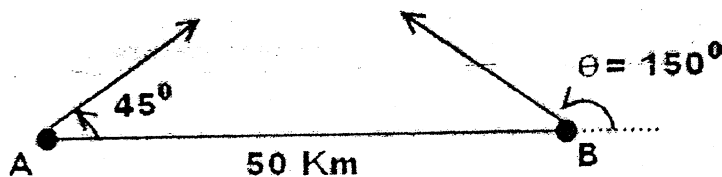
a) What is the doppler frequency shift recorded by the radar in aircraft A?
b) Is this shift positive or negative?

6. Draw the Block diagram of CW and FM-CW Radar. What are the major different between these two Radars? [3+4]

7. What is a delay line canceller? Illustrate the concept of blind speeds based on the frequency response of a single delay line canceller. How does blind speed can be minimized in case of MTI Radar? [2+3+3]

8. What is Tracking Radar? Compare the different types of trackers. Differentiate between MTI radar and Pulse Doppler radar with Block Diagrams. [2+4+4]

9. Discuss the factors limiting the performance of an MTI system. In a MTI radar the pulse repetition frequency is 200 Hz and the carrier transmission frequency are 100 MHz Find its first, second and third blind speeds. [3+4]

10. Substantiate the requirements of Duplexers in efficient radar systems. Describe the operations of branch and balanced type duplexers with necessary diagrams. [2+3+3]

11. Write Short notes [Any Two] [2* 3]
    a) Conical Scan.
    b) Super Heterodyne Receiver
    c) Detection of Radar signal in Noise

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