

BEI

IVI

Question Bank



TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 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. a) Compare and contrast the second, third and fourth generation of mobile communication standards in terms of technology advancement. [4]
- b) Define forward and reverse channel. [2]
2. a) A wireless communication transmitter has an output power of 165 watts at a carrier frequency of 325 MHz. It is connected to an antenna with a gain of 12 dBi. The receiving antenna is 15 km away and has a gain of 6 dBi. Calculate the power delivered to the receiver, considering free-space propagation. (Assume that there are no other losses or mismatches in the system.) [6]
- b) Derive the formula for co-channel reuse ratio: $Q = \sqrt{3N}$. [4]
3. a) Define path loss. Explain the parameters of mobile multipath a channels used to classify various types of fading. [2+4]
- b) Determine the mean path loss using Okumura's model for $d = 50$ km, $h_{te} = 100$ m, $h_{re} = 10$ m in a suburban environment. If the base station transmitter radiates an EIRP of 1kW at a carrier frequency of 900 MHz. Find EIRP (dBm) and the power at the receiver where the gain at receiving antenna is 10 dB. The medium attenuation factor is 43 dB and the gain due to area is 9 dB for a 50 km distance and 900 MHz frequency of operation. [4+2+2]
- c) What do you mean by Ericsson Multiple Breakpoint model? [2]
4. Explain the operation of Orthogonal Frequency Division Multiplexing (OFDM) with an appropriate block diagram of the transmitter and receiver. [8]
5. a) Why is there a need to implement diversity? Describe the Maximum ratio combining space diversity technique. [2+2]
- b) Why interleaving is needed in wireless communication? Explain its working in brief. [4]
6. a) Explain sub-band coding with transmitter and receiver. [6]
- b) Construct Hadamard matrix for H_8 . [4]
7. a) Explain the working of FHMA technique with an appropriate block diagram. [6]
- b) Explain any two hybrid multiple access techniques. [4]
8. a) Explain the operation of the Broadcast control channel (BCH) and Common control channel (CCCH) in GSM. [4+4]
- b) Draw forward CDMA (IS-95) channel. [4]

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2081 Baishakh

Exam.	Back		
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.
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1. What do you mean by duplexing? Explain its different types. [2+4]
2. a) For a cluster $N = 7$ system with a blocking probability of 1% and an average call length of two minutes, find the traffic capacity loss for a blocked calls cleared system due to trunking for 57 channels when going from omnidirectional antennas to 60° sectorized antennas. The average request rate per user is 1 call per hour. [2+2+2]

GOS/ Channel	0.5%	1%	2%
1	.005	.0101	.0204
9	3.333	3.783	4.345
19	10.33	11.23	12.33
54	39.47	41.51	44.00
57	42.1	44.2	46.8

- b) What is Hand-off? Explain proper and improper HO with necessary drawing. [1+3]
3. a) What is Doppler spread? Derive the expression for Doppler shift. [2+4]
- b) If a transmitter produces 50 watts of power, express the transmit power in units of (i) dBm, and (ii) dBW. If 50 watts is applied to a unity gain antenna with a 900 MHz carrier frequency, find the received power in dBm at a free space distance of 100 m from the antenna. What is P_r (10 km)? Assume unity gain for the receiver antenna. [1+1+2+2]
- c) Define fading. Show its different types based on delay spread and Doppler spread. [1+3]
4. Explain the transmission and detection process of GMSK modulation technique with appropriate figure and constellation diagram. [8]
5. Define Interleaving. Explain how equalization offsets the ISI introduced by the multipath time-dispersive channel using an example of an adaptive equalizer. [2+6]
6. a) What are different characteristics of speech signals? How they are used in designing of codes? [4]
- b) With the help of a block diagram, explain the operation of a vocoder. [6]
7. a) Explain the working of the Direct Sequence Spread Spectrum (DSSS) technique with an appropriate block diagram. [6]
- b) Compare and contrast between TDMA and FDMA. [4]
8. a) Explain GSM signal processing with necessary figures. [8]
- b) Draw Reverse CDMA (IS-95) channel. [4]

Exam.		Back	
Level	BE	Full Marks	80
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1. Compare and contrast third and fourth generation of mobile communication standards in terms of technology advancement. [4]
2. a) An urban area has a population of two million residents. System A has 394 cells with 19 channels each. Find the number of users that can be supported at 2% blocking if each user average two calls per hour at average call duration of three minutes. Assuming that trunk systems are operated at maximum capacity, compute the percentage market penetration of cellular provider. [5]
- b) Why we need microcell zone concept? Explain microcell zone concept in brief. [3]
3. a) Describe briefly the types of small scale fading in radio propagation. Explain the factors which influences small scale fading. [4+4]
- b) Assume free space propagation, a receiver is located 10 km away from a 50 w transmitter. The carrier frequency is 900 MHz. antenna gain at transmitter and receiver are 1 and 2 respectively, find: [8]
 - i) The power received at the receiver
 - ii) The magnitude of E-field at the receiver antenna
 - iii) The power flux density
 - iv) The rms voltage applied to the receiver input.

The receiver antenna has a purely real impedance of 50 Ω and is matched to the receiver.
4. How can Minimum Shift Keying (MSK) be defined as a special type of continuous phase FSK and Orthogonal Quadrature Phase Shift Keying (OQPSK)? Compare OQPSK, MSK and GMSK in terms of their bandwidth efficiency and power efficiency. Which of them are suitable for modulation in GSM and Why? [3+3+2]
5. Why Equalization and diversity are needed in wireless communication systems? List out different diversity reception methods used for space diversity. Explain any one of them. [3+3+2]
6. What are the characteristics of speech signal? Explain about Linear Predictive Coders (LPC) with neat block diagram. [2+6]
7. a) Explain the non-linear effect in FDMA. If the total spectrum allocation is 25 MHz, the guard band allocated at the edge of the spectrum is 100 KHz, and the channel bandwidth is 200 KHz. Find the number of channels available in an FDMA system. [3+2]
- b) Explain the Frequency Hopped Multiple Access (FHMA) technique using its transmitter and receiver blocks. [7]
8. Explain the operation of each component in GSM architecture. [8]
9. Write short notes on: (Any Two) [2×4]
 - a) CDMA design considerations
 - b) Regulatory issues in wireless communication
 - c) Interference in wireless/mobile communication

TRIBHUVAN UNIVERSITY
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2079 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
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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.
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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) ~~120°~~ sectoring, and (c) 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]

Hata Model

$$L_{50}(\text{urban})(\text{dB}) = 69.55 + 26.16 \log f_c - 13.82 \log h_{re} - \alpha(h_{re}) + (44.9 - 6.55 \log h_{re}) \log d$$

For medium sized city

$$\alpha(h_{re}) = (1.1 \log f_c - 0.7) h_{re} - (1.56 \log f_c - 0.8) \text{dB}$$

For large city

$$\alpha(h_{re}) = 8.29 (\log 1.54 h_{re})^2 - 1.1 \text{ dB Large City } (f_c \leq 300 \text{ MHz})$$

$$\alpha(h_{re}) = 3.2 (\log 11.75 h_{re})^2 - 4.97 \text{ dB Large City } (f_c > 300 \text{ MHz})$$

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

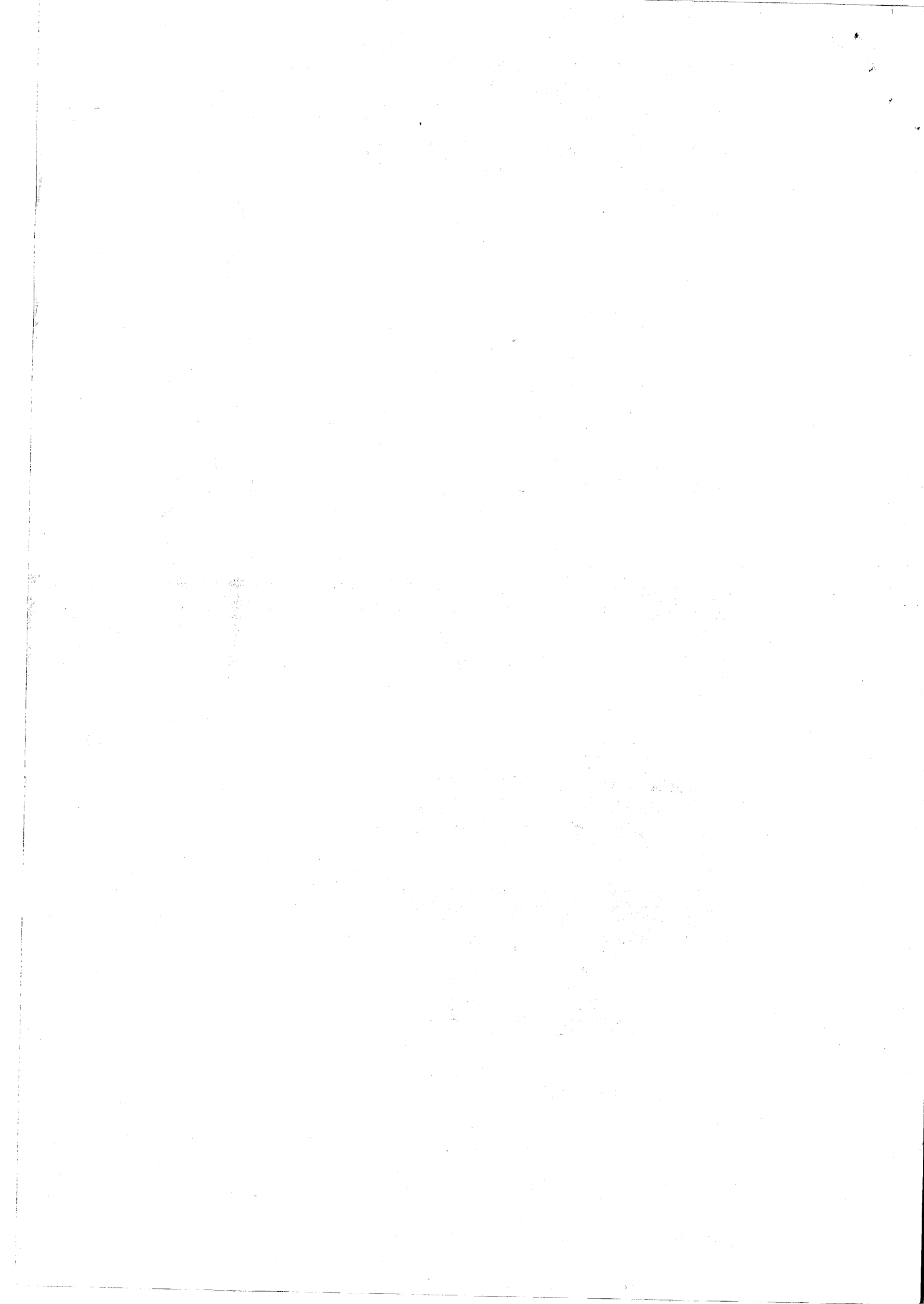
Subject: - Wireless Communication (EX751)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
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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 propagation. Explain the factors which influence small scale fading. [2+4+4]
5. Determine the smallest symbol period T_s , 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 radio 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 spread 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 decoding algorithm
 - c) Wireless local Area Network (WLAN)



Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
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Subject: - Wireless Communication (EX751)

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1. Compare and contrast the first, second, third and fourth 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 antenna 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

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

Subject: - Wireless Communication (EX751)

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- ✓ Attempt All questions.
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1. Briefly explain development of mobile communication and evolution path upto 3G technology. [4]
2. (a) Explain handover process in cellular system. Mention various types of handover with application [6]
(b) Obtain the expression $\frac{S}{I} = \frac{n\sqrt{3N}}{i_0}$ where symbols have their usual meaning. [4]
3. Explain Okumura model of outdoor radio propagation. Determine the median path loss for T-R separation of 50Km, transmit antenna effective height of 100m and receive antenna effective height of 10m in a suburban area with correction factor of 9dB at 900MHz. Assume median attenuation relative to free space 43dB. [4+4]
4. Explain Diversity techniques used in wireless communication. Give brief description of combining methods used for Space Diversity. [4+4]
5. Describe Spread Spectrum Multiple Access, SSMA variants and application with suitable diagram. [8]
6. Describe Waveform and Voice Coding techniques. Mention characteristics of speech. Draw a suitable diagram of GSM CODEC. [4+2+2]
7. Explain Doppler Spread and Coherence Bandwidth. Classify fading on the basis of RMS Delay spread and Coherence Time. [4+4]
8. Explain briefly channel structure of GSM. Show that TDMA frame efficiency cannot reach 100% in GSM [6+2]
9. Compare system architecture of CDMA with LTE. Mention function of entities in the architecture. [3+5]
10. Write Short Note (Any Two) [2X5]
 - a. Adaptive Equalization
 - b. QPSK
 - c. Turbo Coding

7/22

50

Exam.	Regular		
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Subject: - Wireless Communication

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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 ($f_c \leq 300\text{MHz}$))
 $3.2(\log 11.75h_r)^2 - 4.97$ (Large City ($f_c > 300\text{MHz}$))
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) [3x5]
 - a) Rayleigh and Ricean fading distribution
 - b) Regulatory issues related to spectral licensing
 - c) Viterbi decoding
 - d) GSM System Architecture

Exam.	New Batch (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**

$$L_{50} (\text{urban}) (\text{dB}) = 69.55 + 26.16 \log f_c - 13.82 \log h_{re} - a(h_{re}) + (44.9 - 6.55 \log h_{re}) \log d$$

For medium sized city

$$a(h_{re}) = (1.1 \log f_c - 0.7) h_{re} - (1.56 \log f_c - 0.8) \text{ dB}$$

For large city

$$a(h_{re}) = 8.29 (\log 1.54 h_{re})^2 - 1.1 \text{ dB for } f_c \leq 300 \text{ MHz}$$

$$a(h_{re}) = 3.2 (\log 1.75 h_{re})^2 - 4.97 \text{ dB for } f_c \geq 300 \text{ MHz}$$

$$L_{50} (\text{Suburban}) (\text{dB}) = L_{50} (\text{urban}) - 2 [\log (f_c / 28)]^2 - 5.4$$

$$L_{50} (\text{rural}) (\text{dB}) = L_{50} (\text{urban}) - 4.78 (\log f_c)^2 + 18.33 \log f_c - 40.94$$

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.	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.
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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]

31 TRIBHUVAN UNIVERSITY
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2072 Ashwin

Exam.	Regular		
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Subject: - Wireless Communication (EX751)

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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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Subject: - Wireless Communication (EX751)

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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]

5/17

40/-

31 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
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Exam.	Regular / Back		
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Subject: - Wireless Communication (EX751)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
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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

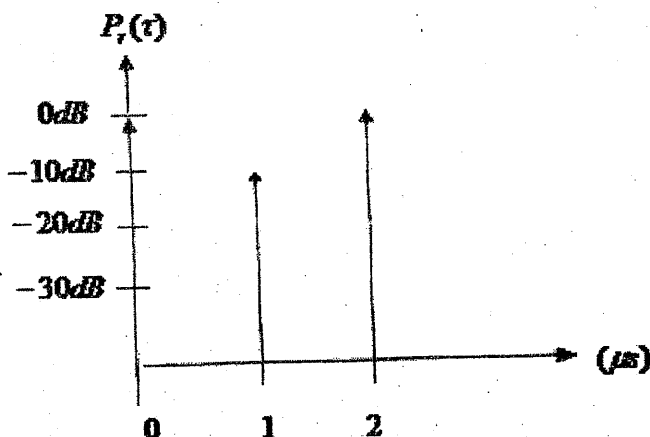
[Use path loss exponent of 4 and consider trunking efficiency]
3. Derive the expression for phase difference in two ray free space propagation model. [8]
4. A mobile is located 5 km away from a base station and a vertical $\lambda/4$ monopole antenna with a gain of 2.55 dB to receive cellular radio signals. 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]

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. 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

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

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Baishakh

Exam.	Back		
	Level	BE	Full Marks
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. How is microwave frequency band classified by the IEEE? Enumerate the basic advantages and disadvantages of microwaves compared to lower frequencies. [2+4]
2. Design a double stub shunt tuner to match a load impedance of $Z_L = 60 - j80 \Omega$ to a 50Ω line. The stubs are to be open circuited stubs and are spaced $3\lambda/8$ apart. Assume the first is 0.4λ from the load. Formulate the S-matrix for your design. [8+2]
3. Why are S-parameters used in microwave network analysis? Derive the S-parameters for a two port network. [2+6]
4. For an air-filled rectangular waveguide with a width of 3 cm and a desired frequency of operation of 6 GHz (for dominant mode), determine cut-off frequency, cut-off wavelength, group velocity, phase velocity, propagation wavelength in the waveguide and the characteristic impedance. Explain the four basic parameters used to describe the performance of a directional coupler. [6+4]
5. Sketch a cross-sectional view of a magnetron having 45 degrees of phase shifts among the adjacent cavities, and explain its functioning as a power amplifier. Explain the bunching effect. [6+2]
6. Investigate the stability of a transistor having following S-parameters at 6GHz. [5+5]

$$[S] = \begin{bmatrix} 0.894 \angle -60.6^\circ & 0.020 \angle 62.4^\circ \\ 3.122 \angle 123.6^\circ & 0.781 \angle -27.6^\circ \end{bmatrix}$$
7. Explain why insertion loss technique is used to design microwave filters. With proper labeling sketch microwave double-section shunt – arm types microwave LPF using micro strips. [3+5]
8. Discuss the possible RF radiation fields to the public exposers. Explain, what are the international standards and recommended (SARPs) practices to safe from such radiation. [3+3]
9. Explain power measurement using calorimeter wattmeter. What are the limitations of using single bridge bolometer? [6+2]
10. Write short notes on: [2×3]
 - a) MASER
 - b) E-plane Tee

Supplied Formulas:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Bhadra

Exam.	Regular		
	Level	BE	Full Marks
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. Differentiate between lumped and distributed circuit analysis. List out the areas of application of microwave system. Provide detail protocols of two microwave communication systems. [3+3+4]
2. A 75Ω coaxial line is terminated with a complex load of $109 + j 120 \Omega$. Design a double-stub matching system using short-circuited coaxial lines. Prepare its S-matrix. [8+2]
3. Briefly explain the need of S-parameter and its properties in microwave analysis. Explain three port network parameters using an example of E-plane Tee. [4+4]
4. What is dominant mode in a waveguide? What are the dominant modes for rectangular and circular waveguides? Does a rectangular waveguide of width 2.254 cm support the propagation of a signal having frequency 6 GHz? [1+1+2]
5. Draw a neat diagram of a magic tee and derive its S-parameter. [4]
6. What is bunching effect? Briefly describe the construction and operation of Traveling Wave Tube (TWT). [2+6]
7. A GaAs MESFET has the following S-parameters measured with a 50Ω resistance at 10 GHz: [10]

$$S_{11} = 0.55 \angle -160^\circ \quad S_{12} = 0.04 \angle 10^\circ$$

$$S_{21} = 4.82 \angle 180^\circ \quad S_{22} = 0.45 \angle -30^\circ$$
 Determine the stability and compare maximum power gains for unilateral and bilateral modes using supplied formulas.
8. How is a low pass filter is prototyped based on Butterworth or Chebyshev approximations and converted into other types of filters? Implement a second order high pass filter π -section using microstrips. [10]
9. Briefly describe power measurement and the working principle of double channel Bolometer Bridge method. [8]
10. Write short notes on: (Any Two) [2×4]
 - a) HERP
 - b) TE_{mn} Field Equations of rectangular waveguide
 - c) Spectrum Analyzer

Supplied Formulas:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2081 Baishakh

Exam.	Back		
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 Equations and Smith Charts are herewith.
- ✓ Assume suitable data if necessary.

1. List out the uses of microwaves in communication systems, and provide detail communication protocols of any three of them. [2+6]
2. Classify microwave propagation fields of a GSM BTS and its radiation parameters. Explain what non-ionizing SAR is and how it becomes hazardous to human body. [4+4]
3. Prepare S-Matrices of a perfectly working E-Plane Tee, H-Plane Tee and a Duplexer, and explore their uses. [8]
4. Define the field equations and the basic characteristic equations of a rectangular waveguide working on TM_{11} mode. [8]
5. Design a double-stub impedance matching network for a load of $\Gamma = 0.64\angle 58^\circ$ connected to a 100 Ohm transmission line. Prepare the S-Matrix of its matched network. [8+2]
6. Calculate the maximum gains of both bilateral and unilateral models of a transistor having the S-parameters of $S_{11} = 0.55\angle -150^\circ$, $S_{12} = 0.04\angle 20^\circ$, $S_{21} = 2.82\angle 180^\circ$ and $S_{22} = 0.45\angle -30^\circ$. Sketch a flow chart that describes the microwave amplifier designing procedure. [6+3+3]
7. Explain the steps of microwave filter designing. Provide a sketch of double pad T-Type passive filter using a micro-strip. [7+3]
8. Explain the working principles of a cross-field magnetron having 60° of phase differences among the adjacent cavities. [8]
9. Write short notes on: (Any Two) [2×4]
 - a) Stability analysis of a microwave amplifier
 - b) Double-channel Bolometer
 - c) Sketch of an Immittance Chart

Supplied Formulas:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Bhadra

Exam. Level	Regular		
	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 50Ω lossless transmission line is required to be matched with the load admittance $0.00813 + j0.0065 \text{ } \Omega$, by a double-stub shunt tuner with separation of $3\lambda/8$ 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

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

- 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 $S_{11} = 0.894 \angle -60.6^\circ$, $S_{21} = 3.122 \angle 123.6^\circ$, $S_{12} = 0.020 \angle 62.4^\circ$, $S_{22} = 0.781 \angle -27.6^\circ$. 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

Supplied Formulas:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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.

$$[S] = \begin{bmatrix} S_{11} & 0 & S_{13} & S_{14} \\ 0 & S_{22} & -S_{13} & S_{14} \\ S_{13} & -S_{13} & 0 & 0 \\ S_{14} & S_{14} & 0 & 0 \end{bmatrix} \quad [6]$$

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 immittance chart? Sketch it. List out all duality parameters vital to designing microwave networks. [10]

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

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

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

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

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

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

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

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

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 $\Gamma_L = 0.5 \angle 51^\circ$ Ohm and surge impedance $Z_0 = 50$ Ohm. [8]
2. Identify 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]

$$[S] = \begin{bmatrix} 0.656 \angle 146.7^\circ & 0.122 \angle 46.1^\circ \\ 2.30 \angle 44.7^\circ & 0.172 \angle -117.1^\circ \end{bmatrix}$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ **Necessary formula and Chart are attached herewith.**
- ✓ 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]

$$S_{11} = 0.78 \angle -113^\circ \quad S_{12} = 0.028 \angle 247^\circ$$

$$S_{21} = 2.60 \angle 76^\circ \quad S_{22} = 0.81 \angle -54^\circ$$
 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 Surveillance 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

Supplied Formulas:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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 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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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 $S_{11} = 0.64\angle -169^\circ$, $S_{12} = 0.03\angle 50^\circ$, $S_{21} = 10.11\angle 91^\circ$, $S_{22} = 0.22\angle -82^\circ$. 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.	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 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 $S_{11} = 0.894 \angle -60.6^\circ$, $S_{12} = 0.020 \angle 62.4^\circ$, $S_{21} = 3.122 \angle 123.6^\circ$ and $S_{22} = 0.781 \angle -27.6^\circ$ 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

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 $S_{11} = 0.45 \angle 163^\circ$, $S_{12} = 0.04 \angle 40^\circ$, $S_{21} = 2.55 \angle -106^\circ$ and $S_{22} = 0.46 \angle -65^\circ$. 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

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 TE₁₀ and TE₂₀ in terms of cut-off frequency and dominant mode. [8+2]
2. Design a double stub matching network using three-eighths wavelength $\left(\frac{3\lambda}{8}\right)$ separation that match an antenna having load of 300+j300 Ohm connected to a 300 Ohm transmission line. Justify your design. [10]
3. What is bunching effect? Describe the working principle of a klystron oscillator. [2+8]
4. Using the given S-parameters $S_{11}=0.55\angle 150^\circ, S_{12}=0.04\angle 20^\circ, S_{21}=2.82\angle 180^\circ, S_{22}=0.45\angle -30^\circ$ 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 $C_S=1.15\angle 10^\circ, R_S=0.85, C_L=1.10\angle 80^\circ, R_L=1.10$. [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:

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

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

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

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

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

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

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

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

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

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

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

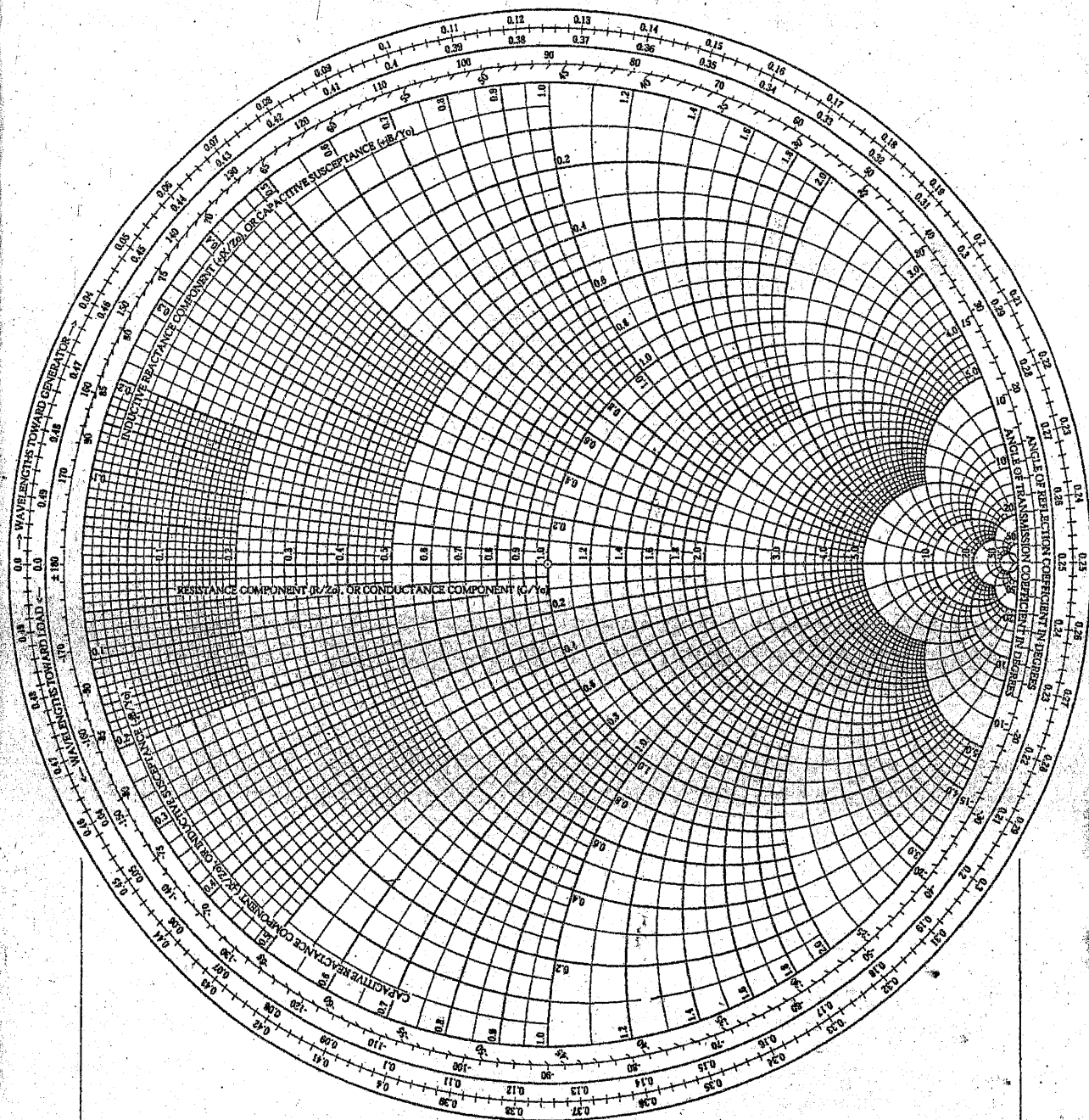
$$R_L = \frac{|S_{12}S_{21}|}{|S_{22}|^2 - |\Delta|^2}$$

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

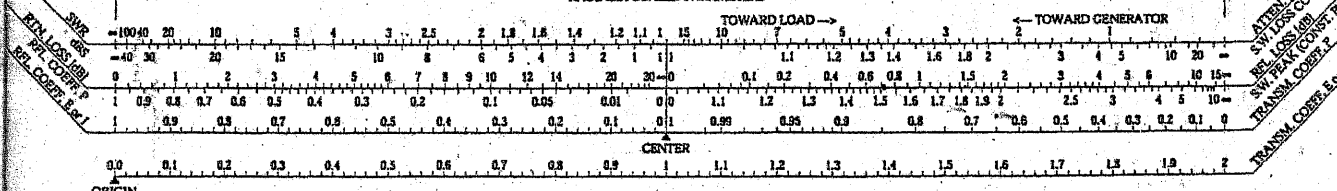
$$G_{Tmax} = \left(\frac{1 - |\Gamma_S|^2}{|1 - S_{11}\Gamma_S|^2} \right) |S_{21}|^2 \left(\frac{1 - |\Gamma_L|^2}{|1 - S_{22}\Gamma_L|^2} \right)$$

The Complete Smith Chart

Black Magic Design



RADIALLY SCALED PARAMETERS



RETURN LOSS
 SWR LOSS COEFF
 TRANSM. COEFF. 1
 TRANSM. COEFF. 2
 TRANSM. COEFF. 3
 TRANSM. COEFF. 4
 TRANSM. COEFF. 5
 TRANSM. COEFF. 6
 TRANSM. COEFF. 7
 TRANSM. COEFF. 8
 TRANSM. COEFF. 9
 TRANSM. COEFF. 10
 TRANSM. COEFF. 11
 TRANSM. COEFF. 12
 TRANSM. COEFF. 13
 TRANSM. COEFF. 14
 TRANSM. COEFF. 15
 TRANSM. COEFF. 16
 TRANSM. COEFF. 17
 TRANSM. COEFF. 18
 TRANSM. COEFF. 19
 TRANSM. COEFF. 20

10/13 D.

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 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 $S_{11}=0.55\angle-150^\circ$, $S_{12}=0.04\angle 20^\circ$, $S_{21}=2.82\angle 180^\circ$ and $S_{22}=0.45\angle-30^\circ$, 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:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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 attached herewith.
- ✓ 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-eighths 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} mode in a rectangular waveguide with a wall separation of 5 cm. [7+3]
5. Find the maximum gain for a microwave transistor amplifier with $S_{11} = 0.656 \angle 146.7^\circ$, $S_{12} = 0.122 \angle 46.1^\circ$, $S_{21} = 2.3 \angle 44.7^\circ$, $S_{22} = 0.172 \angle -117.1^\circ$. [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) [2x5]
 - a) Mixer theory
 - b) Circulators
 - c) Microwave radiation hazards and safety practices

Supplied Formulas:

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

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

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

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

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

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

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

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

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

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

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

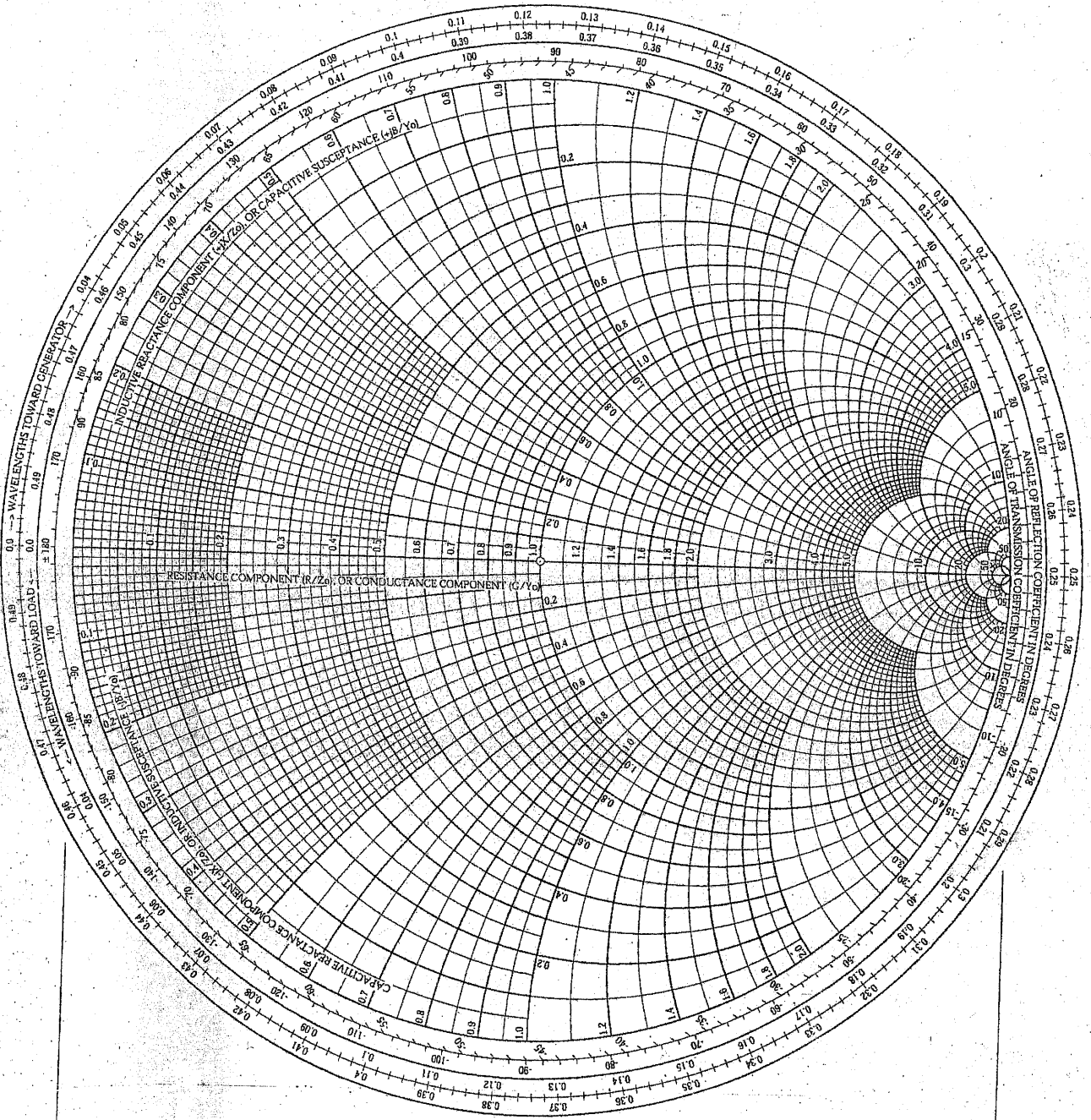
$$R_L = \frac{|S_{12} S_{21}|}{|S_{22}|^2 - |\Delta|^2}$$

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

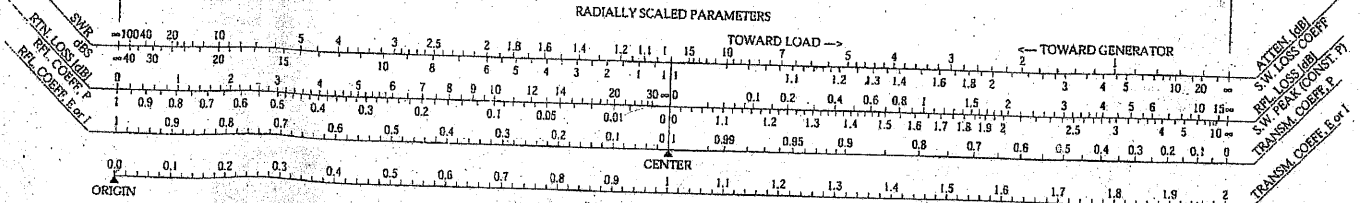
$$G_{Tmax} = \left(\frac{1}{1 - |\Gamma_S|^2} \right) |S_{21}|^2 \left(\frac{1 - |\Gamma_L|^2}{1 - S_{22} \Gamma_L^*} \right)$$

The Complete Smith Chart

Black Magic Design



RADIALLY SCALED PARAMETERS



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 supplied herewith.
- ✓ 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-eighth 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 $S_{11} = 0.894 \angle -60.6^\circ$, $S_{12} = 0.020 \angle 62.4^\circ$, $S_{21} = 3.122 \angle 123.6^\circ$ and $S_{22} = 0.781 \angle -27.6^\circ$ 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:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEI, 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. A discrete time system has input $x(n)$ and output $y(n)$. The input output relation of the system is given by

$$y(n) = \sum_{k=0}^n x(k)$$

Check whether the system is memory less, time invariant and stable or not? [2+2+2]

2. Determine whether the given signal is periodic or not. If the signal is periodic, determine

the fundamental period $x[n] = e^{\frac{j\pi n}{16}} \cos\left\{\frac{n\pi}{17}\right\}$. [5]

3. Define the Region of Convergence (ROC) [1+6]

Find the inverse of $H(z) = (1 + 2z^{-1} + z^{-2}) / (1 - 0.75z^{-1} + 0.125z^{-2})$; ROC $0.25 < |z| < 0.5$

4. Plot the pole-zero on the z-plane and draw Magnitude response (not to the scale) of an LTI system described by the equation, $y(n) = x(n) + 0.8x(n-1) + 0.8x(n-2) + 0.49y(n-2)$. [3+7]

5. Draw the Lattice structure from the following system function.

$$H(z) = \frac{1}{1 - 0.2z^{-1} + 0.4z^{-2} + 0.6z^{-3}}$$
 [10]

6. Design the symmetric FIR Low Pass Filter (LPF) for which the desired frequency response is expressed as [10]

$$H_d(W) = e^{-jW\tau}, |W| \leq W_c \text{ and } 0 \text{ elsewhere. The length of the filter should be } 7 \text{ and } W_c = 1 \text{ rad/sample. Make use of the Hanning window.}$$

7. Kaiser window is to be used to design a linear phase FIR filter that meets following specification [2+2+2]

$$\begin{aligned} |H(e^{j\omega})| &\leq 0.01, & 0.21\pi \leq |\omega| \leq \pi \\ 0.95 \leq |H(e^{j\omega})| &\leq 1.05, & 0 \leq |\omega| \leq 0.19\pi. \end{aligned}$$

Calculate the optimum value of ripple, attenuation and window length.

8. Using Bilinear transformation, design a Butterworth low pass filter which satisfies following conditions:

$$0.9 \leq |H(e^{j\omega})| \leq 1, \quad \text{for } 0 \leq \omega \leq \frac{\pi}{2}$$

$$|H(e^{j\omega})| \leq 0.2, \quad \text{for } \frac{3\pi}{4} \leq \omega \leq \pi$$
 [12]

Consider sampling frequency of 1 Hz.

9. Compute 8-point DIF-FFT of sequence $x(n) = \{2, 1, 2, 1, 1, 2, 1, 2\}$. [8]

10. Obtain the circular convolution of the following sequences:

$$x_1(n) = \{1, 2, 3, 1\} \text{ and } x_2(n) = \{4, 3, 2, 2\}$$
 [6]

Exam.	Back		
Level	BE	Full Marks	80
Programme	BEI, 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. A discrete-time LTI system is given by difference equation $y(n) = x(n) + e^a y(n-1)$. Check this system for BIBO stability. [5]

2. Find the output $y(n)$ of LTI system having impulse response $h(n) = \left(\frac{1}{3}\right)^n u(n-3)$ and input $x(n) = \left(\frac{1}{6}\right)^{n-6} u(n)$. [6]

3. Determine the inverse z-transform of $X(z) = \frac{1}{1-0.8z^{-1}+0.12z^{-2}}$. (i) if ROC is $|z| > 0.6$ (ii) if ROC is $|z| < 0.2$ (iii) if ROC is $0.2 < |z| < 0.6$ [2+2+3]

4. Plot the pole-zero in z plane and draw the magnitude response (not to the scale) of the system described by difference equation $y(n) = 0.67 x(n) - 0.3 x(n-1) + 2.75 y(n-1)$ [3+7]

5. a) Draw the cascaded form structure of $H(z) = 10(1-0.25z^{-1})(1-0.667z^{-1})(1+2z^{-1})/(1-0.75z^{-1})(1-0.125z^{-1})\{1-(0.5+j0.5)z^{-1}\}\{1-(0.5-j0.5)z^{-1}\}$ [5]
 b) Draw the lattice structure for the given FIR filter and also check whether the system is stable. $H(z) = 1 + (13/24)z^{-1} + (5/8)z^{-2} + (1/3)z^{-3}$ [5]

6. Design a linear phase FIR filter using suitable window to meet following specifications:
 $0.99 \leq |H(e^{jw})| \leq 1.01, \text{ for } 0 \leq |w| \leq 0.3\pi$
 $|H(e^{jw})| \leq 0.01, \text{ for } 0.35\pi \leq |w| \leq \pi$ [10]

7. What is Gibbs phenomenon and how can it be minimized? Why Kaiser window is better than other fixed windows in FIR filter design? [3+3]

8. Differentiate between bilinear transformation and impulse invariance. Design a Butterworth digital IIR lowpass filter using bilinear transformation by taking $T = 0.1$ second, to satisfy the following specifications. [2+10]
 $0.6 \leq |H(e^{j\omega})| \leq 1, \quad 0 \leq \omega \leq 0.35\pi$
 $|H(e^{j\omega})| \leq 0.1, \quad 0.7\pi \leq \omega \leq \pi$

9. Why Decimation in Time Fast Fourier Transform (DITFFT) Algorithm is better than direct computation of DFT? Find 4 point DFT of the sequence $x(n) = \{2,2,4\}$ using DITFFT algorithm. [2+6]

10. Compute circular convolution of the following two sequences using DFT. $x(n) = \{1,2,4,5\}$ and $h(n) = \{2,1,6,8\}$ [6]

Exam.	Back		
Level	BE	Full Marks	80
Programme	BEL, 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. Check whether following signals are periodic or not. If yes, state their periodic time. [2+2]
 - a) $x[n] = \sin(n\pi) + \cos(n\pi)$
 - b) $x[n] = \sin(3n\pi/5) + \cos(4n\pi/7)$
2. Find the output of LTI system having impulse response $h[n] = (1/2)^{n*} u[n]$ and input $x[n] = 5e^{j\pi n/3}$ for $-\infty < n < \infty$. [5]
3. Define ROC. Find inverse z-transform of $X(z) = (1+2z^{-1}+z^{-2})/(1-1.5z^{-1}+0.5z^{-2})$, ROC: $|z| > 1$. [1+5]
4. Differentiate between FIR system and IIR System. The poles of a system are located at $0.45 \pm j1.6$ and zeros at $0.58 \pm j2.06$. Map the poles and zeros in the z-plane and plot the magnitude response (not in scale) of the system. [4+6]
5. Compute Lattice-ladder coefficients and draw lattice structure for given system
 $H(z) = (2 - 0.7z^{-1} + 0.5z^{-2})/(1-0.3z^{-1} + 0.25z^{-2})$. [6]
6. Realize the given system in Cascade Form of 2nd order section flow graph representation.
 $H(z) = \{(1-0.4z^{-1})(1+0.2z^{-1})(1-0.3e^{j\pi/6}z^{-1})(1-0.3e^{-j\pi/6}z^{-1})\} / \{(1-0.5e^{j\pi/3}z^{-1})(1-0.5e^{-j\pi/3}z^{-1})(1+0.7e^{j\pi/4}z^{-1})(1+0.7e^{-j\pi/4}z^{-1})\}$. [4]
7. In which case do we choose FIR filter and IIR filter? Design a linear phase FIR filter using Kaiser Window to meet the following specifications: [2+8]

$$0.99 \leq |H(e^{jw})| \leq 1.01 \quad \text{for } 0 \leq w \leq 0.016\pi$$

$$|H(e^{jw})| \leq 0.01 \quad \text{for } 0.08\pi \leq w \leq 2\pi$$
8. Explain in detail about how Gibb's oscillation arise while using the rectangular window in FIR filter design. [5]
9. Design a low pass digital IIR filter by Bilinear Transformation method to an approximate Butterworth low pass filter, if passband edge frequency is 0.26π radians and maximum deviation of 0.99 dB below 0 dB gain in the passband. The maximum gain of -14.99 dB and frequency is 0.58π radians in stopband, Consider sampling frequency 0.5 Hz. [11]
10. Describe digital domain Spectral Transformation features and parameters for low pass to high pass in IIR Filter design. [4]
11. How fast is FFT? Find 8-point DFT of sequence $x[n] = \{1, 1, 0, 0, 1, 1, 2\}$ using Decimation in Time Fast Fourier Transform(DITFFT) algorithm. [2+6]
12. Write the complexity of DFT and FFT? Obtain the circular convolution of the following sequences: [2+5]

$$X_1[n] = \{1, 2, 3, 1\} \text{ and}$$

$$X_2[n] = \{4, 3, 2, 2\}$$

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEI, 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 energy and power signal. Determine whether the signal $x[n] = \cos\left[\frac{2\pi n}{5}\right] + \sin\left[\frac{\pi n}{3}\right]$ 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:
 $y[n] - 0.35y[n-1] + 0.25y[n-2] = x[n] - 0.75x[n-1]$. [3+7]
5. Draw direct form I and Direct form II realization of the following system.
 $y[n] = -0.25y[n-2] + x[n] + 0.4x[n-1] + 0.5x[n-2]$ [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]

$$0.899 \leq |H(e^{jw})| \leq 1 \quad \text{for } |w| \leq 0.2\pi$$

$$|H(e^{jw})| \leq 0.01 \quad \text{for } 0.4\pi \leq w \leq \pi$$
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) = 0.25π radians
 Stopband frequency (W_s) = 0.55π radians
 Passband ripple (δ_p) = 0.11
 Stopband ripple (δ_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]

TRIBHUVAN UNIVERSITY
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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

$$x[n] = e^{j\left(\frac{\pi}{2}n + \frac{4\pi}{7}\right)} \text{ is energy signal or power signal.} \quad [2+2]$$

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 $H(z) = \frac{z}{3z^2 - 4z + 1}$ 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]

$$y[n] - 0.3y[n-1] + 0.2y[n-2] = x[n] - 0.5x[n-1]$$

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 0.24π 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 0.57π 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]



2078/05/29

TRIBHUVAN UNIVERSITY
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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 $x[n] = \cos\left[\frac{\pi n}{2}\right] \cdot \cos\left[\frac{\pi n}{4}\right]$ 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: $|z| < 1/2$. [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 $H(z) = 1 + \frac{13}{24}z^{-1} + \frac{5}{8}z^{-2} + \frac{1}{3}z^{-3}$. 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]

$$\begin{cases} |H(e^{jw})| \leq 0.01; & 0 \leq w \leq 0.25\pi \\ 0.95 \leq |H(e^{jw})| \leq 1.05; & 0.35\pi \leq w \leq 0.6\pi \\ |H(e^{jw})| \leq 0.01; & 0.65\pi \leq w \leq \pi \end{cases}$$
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]

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. 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]

$$H(z) = \left\{ (1 - 0.5z^{-1})(1 + 0.35z^{-1})(1 - 0.3e^{j2\pi/5}z^{-1})(1 - 0.3e^{-j2\pi/5}z^{-1}) \right\} / \left\{ (1 - 0.6e^{j\pi/3}z^{-1})(1 - 0.6e^{-j\pi/3}z^{-1})(1 + 0.5e^{j2\pi/7}z^{-1})(1 + 0.5e^{-j2\pi/7}z^{-1}) \right\}$$
8. Design the FIR filter using suitable window for the specifications: [6]

$$0.899 \leq |H(e^{j\omega})| \leq 1, \text{ for } |\omega| \leq 0.2\pi$$

$$|H(e^{j\omega})| \leq 0.01, \text{ for } 0.4\pi \leq \omega \leq \pi$$
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 ≤ 1 dB
 - Passband edge frequency = 1.2 KHz
 - Stopband Attenuation ≥ 40 dB
 - Stopband edge frequency = 2.5 KHz
 - Sample rate = 8 KHz
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]

TRIBHUVAN UNIVERSITY
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Examination Control Division
 2076 Ashwin

Exam.	Back		
	Level	BE	Full Marks
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 Dirichlet'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 $X(z) = z / \{(z - 0.6)(z + 0.5)^2\}$, 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 (ω_p) = 0.22π radians
 Stop bandedge frequency (ω_s) = 0.54π radians
 Passband ripple (δ_p) = 0.11
 Stopband ripple (δ_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]

$$0.99 \leq |H(e^{jw})| \leq 1.01, \quad \text{for } 0 \leq w \leq 0.16\pi$$

$$|H(e^{jw})| \leq 0.01, \quad \text{for } 0.18\pi \leq w \leq 2\pi$$

Draw the flow chart for Remez- Exchange algorithm

TRIBHUVAN UNIVERSITY
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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 $-1 \leq n \leq 3$. 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

$$y(n) - 0.3y(n-1) = 2x(n-2) + 0.7x(n-1) + 4x(n) \quad [2+7]$$

4. Draw the lattice structure from the following system function

$$H(z) = \frac{1}{1 + \frac{2}{3}z^{-1} + \frac{5}{8}z^{-2} + \frac{2}{3}z^{-3} + z^{-4}} \quad [9]$$

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

$$x[n] = (0.1)^n u[n] + (0.3)^n u[-n-1] \quad [4+6]$$

7. Using bilinear transformation, design a digital filter using Butterworth approximation which satisfies the following conditions

$$0.8 \leq |H e^{jW}| \leq 1 \text{ for } 0 \leq W \leq 0.2\pi$$

$$|H e^{jW}| \leq 0.2 \text{ for } 0.6\pi \leq W \leq \pi$$

[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

$$X_1[n] = \{0, 0, 1, 1\} \text{ and } X_2[n] = \{1, 1, 1, 1\}$$

[3+7]

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) $y[n] = \cos\left(\frac{5\pi}{8}n + \frac{\pi}{4}\right)$

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]

$$\frac{1}{3 + \frac{39}{24}Z^{-1} + \frac{15}{8}Z^{-2} + \frac{3}{9}Z^{-3}}$$

And represent $\frac{5}{8}$ and $-\frac{5}{8}$ in sign magnitude, 1's complement and 2's complement format. [12]

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 0.15π
- 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]

$$0.99 \leq |H(e^{jw})| \leq 1.01, \quad \text{for } 0 \leq w \leq 0.19\pi$$

$$|H(e^{jw})| \leq 0.01, \quad \text{for } 0.21\pi \leq w \leq \pi$$

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]

$$x_1(n) = \{1, 2, -1, 1\} \quad \text{and} \quad x_2(n) = \{1, 3, 5, 7\}$$

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 Non-linear
3. Define a ROC. What are the properties of ROC of z-transform? Find the inverse Z-transform of $X(z) = (2z^2 + 2z + 3z + 5)/(z^2 - 0.1z - 0.2)$, ROC: $|z| < 0.4$. [1+3+5]
4. The poles of a system are located at: $0.45 - 0.77i$ and $-2 \pm 0.3i$. 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 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]

$$|H(e^{jw})| \leq 0.01, 0 \leq |w| \leq 0.25\pi$$

$$0.95 \leq |H(e^{jw})| \leq 1.05, 0.35\pi \leq |w| \leq 0.6\pi$$

$$|H(e^{jw})| \leq 0.01, 0.65\pi \leq |w| \leq \pi$$

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 $x[n] = \{1.5, -1, 1.8, 0.6, 3, 1.7\}$ [3+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]

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 $X(z) = z^2 \left[1 - \frac{3}{2}z^{-1} \right] (1+z^{-1})(1-z^{-1})$ [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 bandedge frequency (ω_p) = 0.27π radians
 Stop bandedge frequency (ω_s) = 0.58π radians
 Passband ripple (δ_p) = 0.11
 Stopband ripple (δ_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 $X_3(k) = X_1(k), X_2(k)$. [1+7]

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: $0.45 + 0.77i$ and $2 \pm 0.7i$ and zeros at: $1.2 \pm 0.43i$. 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 $T = 1$ sec 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]

$$0.98 \leq |H(e^{jw})| \leq 1.02, \text{ for } 0 \leq w \leq 0.9\pi$$

$$|H(e^{jw})| \leq 0.01, \text{ for } 0.14\pi \leq w \leq \pi$$

8. Draw the Howchart 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 $x_3[n]$ 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 $x_1[n] = \{1, -2, 5, 1, 2\}$ and $x_2[n] = \{1, 2, -3, -2\}$ respectively. [7]

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. 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 $x[n] = 10 - 5 \sin(\pi n / 2) + 20 \cos \pi n$ $-\infty < n < \infty$. [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]

$$0.89125 \leq |H(e^{j\omega})| \leq 1 \quad \text{for } 0 \leq \omega \leq 0.2\pi$$

$$|H(e^{j\omega})| \leq 0.17783 \quad \text{for } 0.3\pi \leq \omega \leq \pi$$
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]

12/16

31 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Chaitra

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 impulse 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]

Exam.	New Batch (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. 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]
- $$0.99 \leq |H(e^{j\omega})| \leq 1.01, \text{ for } 0 \leq \omega \leq 0.19\pi$$
- $$|H(e^{j\omega})| \leq 0.01, \text{ for } 0.21\pi \leq \omega \leq \pi$$
9. Design a low pass digital filter by Bilinear Transformation method to an approximate Butterworth filter, if passband edge frequency is 0.25π radians and maximum deviation of 1 dB below 0 dB gain in the passband. The maximum gain of -15 dB and frequency is 0.45π 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]

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. 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]

$$X(z) = 1 / \{(z - 0.5)(z + 2)\}, \text{ if}$$

- 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]

$$\text{Pass band frequency } (\omega_p) = 0.25\pi \text{ radians}$$

$$\text{Stop band frequency } (\omega_s) = 0.55\pi \text{ radians}$$

$$\text{Pass band ripple } (\delta_p) = 0.11$$

$$\text{and stop band ripple } (\delta_s) = 0.21$$

$$\text{Consider sampling frequency } 0.5 \text{ Hz.}$$

Also, convert the obtained digital low-pass filter to high-pass filter with new pass band frequency $(\omega'_p) = 0.45\pi$ 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]
- $$x(n) = \{1, 0, 0, 0, 0, 0, 0, 0\}$$

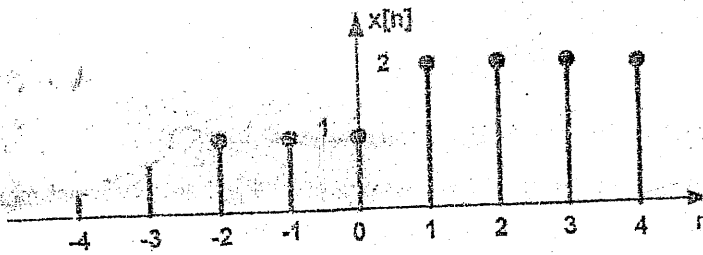
Exam.	BE	Full Marks	80
Level	BE	Pass Marks	32
Programme	BCT	Time	3 hrs.
Year / Part	IV / I		

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,

$$x[n] = \begin{cases} 1 & -1 \leq n \leq 1 \\ 0 & \text{elsewhere} \end{cases} \text{ and } h[n] = \begin{cases} 1 & -1 \leq n \leq 1 \\ 0 & \text{elsewhere} \end{cases} \text{ Find the output of the system using graphical method.}$$

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 $x[n] = Ae^{int}$

4. If a 3 stage lattice filter for all pole polynomial has coefficients.

[5]

$$K_1 = \frac{1}{4}, K_2 = \frac{1}{2} \text{ and } K_3 = \frac{1}{3} \text{ Obtain the system function of this filter.}$$

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]

Exam.	Program		
Level	BE	Full Marks	80
Programme	BCF	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]

$$h[n] = (1/3)^n u[n] \text{ and input signal } x[n] = 5e^{j\pi n/2} \text{ for } -\infty < n < \infty.$$
5. Plot Magnitude Response (not to the scale) of the system described by difference equation. $y[n] - 0.3 y[n-1] + 0.225 y[n-2] = x[n] + 0.5 x[n-1]$ [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 satisfies the following conditions: [10]

$$\begin{aligned} 0.8 \leq |H_e^{j\omega}| \leq 1 & \quad \text{for } 0 \leq \omega \leq 0.2\pi \\ |H_e^{j\omega}| \leq 0.2 & \quad \text{for } 0.6\pi \leq \omega \leq \pi \end{aligned}$$
11. A digital LPF with cut off frequency $\omega_c = 0.2575 \pi$ is given as $H(Z) = \frac{0.1 + 0.4z^{-1}}{1 - 0.6z^{-1} + 0.1z^{-2}}$ [5]

Design a digital high pass filter with $\omega'_c = 0.3567\pi$.
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]

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 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. 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: $y(n) = x(n) + x(n-2)$ [2+6+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 (ω_p) = 0.25π , stop-band edge frequency (ω_s) = 0.35π 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 0.2π radians and maximum deviation of 0.5 dB below 0 dB gain in the passband. The maximum gain of -15 dB and frequency is 0.35π 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 $x[n] = \{1, 2\}$ and $y[n] = u[n] - u[n-4]$. [2+5]
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]
 $x(n) = \{1, 0, 0, 0, 0, 0, 0, 0\}$

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 $y[n] - 0.4y[n-1] + 0.2y[n-2] = x[n] + 0.1x[n-1] - 0.06x[n-2]$ [2+2+6]
5. Determine the Direct Form II realization of the following system $y(n) = -0.1y(n-1) + 0.72y(n-2) + 0.7x(n) - 0.252x(n-2)$ [4]
6. Compute the lattice coefficients and draw the lattice structure of following FIR system $H(z) = 1 + 2z^{-1} - 3z^{-2} + 4z^{-3}$ [6]
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 (ω_p) = 0.25π radians
 - Stop band frequency (ω_s) = 0.55π radians
 - Pass band ripple (δ_p) = 0.11
 - And stop band ripple (δ_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 (ω'_p) = 0.45π 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]

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL, BEX, BEI, 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 there a need for different levels of managements? List out the different models of management and write down short note on any two with proper example you are aware of. [4+4]
2. Explain Scientific Management theory with proper examples. Is it still applicable in modern-day management practices? [5+3]
3. What are the differences between single ownership and organization joint stock company? [8]
4. How would you define organization? How can you describe principles of organization? Elaborate the importance of organization. [1+4+3]
5. What is personal management? Elaborate the various factors of wage and salary structure with proper examples. [4+4]
6. Define the term outsourcing. Explain the process of recruitment and selection of manpower in an organization. [3+5]
7. According to Herzberg's motivation-hygiene theory, where does motivation at work come from? Vroom's Valency theory is known as type of process theory, justify it. [4+4]
8. What characteristics differentiate a Leader from regular employees? Explain Blakes and Mouton's Managerial Grid with proper examples. [4+4]
9. Discuss the major steps of case study with relevant examples related to your field of study. [8]
10. What are the role of MIS in any organization? Explain the four types of information systems. [3+5]

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2081 Baishakh

Exam.	Back	
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 different functions of management. List out the major skill desired for successful manager. [4+4]
2. Explain the scientific management theory with its historical development. What are the major differences between the scientific management theory and behavioral management theory? [4+4]
3. How would you clarify the characteristics of Joint Stock Company? What are the major differences between Joint Stock Company and Public Corporation? [4+4]
4. What are the major function of marketing? Explain the importance of marketing in this modern digital era. [4+4]
5. What is the main idea of personal management? Explain steps of the HR planning process. What are the methods of scientific selection of manpower in organization? [1+4+3]
6. How can you compare Job evaluation with Merit Rating? How would you generate Job description and job specification of Lecture post in engineering college? [3+5]
7. What role does management play in motivating their employees? Explain McGregor's Theory X and Theory Y. [3+5]
8. What are the qualities of good leader? Why we need to promote entrepreneurship in the context of Nepal? [4+4]
9. What are the major objectives of case study? Discuss the different steps of conducting case study. [3+5]
10. What is the importance of MIS? Explain database information system with suitable example. [3+5]

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Baishakh

Exam.	Back	
Level	BE	Full Marks 80
Programme	BEL, BEX, BEI, 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. What are the basic functions of management? In your opinion which management theory is the most practical and fruitful in today's business scenario? [4+4]
2. Define personal management and explain the function of personal management. [8]
3. Explain the difference between administrative management approach and behavioral management approach. [8]
4. What is the process of formation of a joint-stock company in Nepal? What are the advantages and disadvantages of a joint-stock company? [4+4]
5. Explain about the personal policy and describe about the importance of manpower planning in an organization. [4+4]
6. Explain the vroom's expectancy theory of motivation. [8]
7. Which style you recommend as most effective leader in industrial organization? [8]
8. Explain about the case study and explain about the objectives of case study in detail. [4+4]
9. What are case studies? Why are case studies conducted? What are the different types of case studies? [4+2+2]
10. Explain how the management information system is used in different levels of management within an organization. [8]



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]

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 management. 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

2078/06/10

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Bhadra

Exam.	Regular		
Level	BE		Full Marks 80
Programme	BEL, BCT	BEX.	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. "Management is both a science and an art". Discuss this statement, giving suitable examples. What are the managerial skill a modern manager needs to be equipped with? [1+3+4]
2. What are the functions of Management? Explain different levels of management. What are the qualities of good manager? [3+2+3]
3. What advantage does behavioral management theory has over scientific management theory? Explain in brief. [8]
4. Define advertising and importance of marketing. Explain the Principle of purchasing. [1+3+4]
5. While ascending up the Maslow's pyramid some people fall from the grace (ie. they end up in cases like fraud, crime, rape, suicide, murder, jail terms, etc.) Describe this irony form your own perspective. [8]
6. Define term wages and merit ranking. Differentiate between recruitment and selection. Explain the scientific selection of manpower and methods of job analysis. [2+3+3]
7. Define Manpower Planning. Why is it important to discuss Personnel Policy with the employees at Hiring? [3+5]
8. Explain briefly about comparison of Alderfer and Herzberg's Theories. Explain the Vroom's expectancy of motivation theory. [3+5]
9. Define the term leadership. Which leadership style is appropriate in the modern engineering project. Explain in brief. [3+5]
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]

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]

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]

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

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]

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]

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]



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]

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]

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]

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.

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 Hygiene 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]

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

12 / 23

12 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 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 (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]

Examination Control Division

2070 Ashad

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)

12 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2069 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 (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

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. Define Artificial Intelligence and Intelligent agent. Differentiate between different types of intelligent agent with examples. [2+6]
2. What is constraint satisfaction problem? Solve the following cryptarithmic problem. [2+6]
TEN + TEN + FORTY = SIXTY
3. How searching is done in adversarial search? How A* search overcomes problem associated with Greedy Search? Explain with example. [2+6]
4. Consider the following axioms:
 - i) Ram likes all kinds of food.
 - ii) Apples and vegetables are food.
 - iii) Anything anyone eats and not killed is food.
 - iv) Anil eats peanuts and is still alive.
 - v) Ram eats everything that Anil eats.Proof that "Ram likes peanuts" using resolution refutation. [8]
5. What do you understand by Bayesian Network? In a County, 51% of the adults are males and the other 49% are females. One adult is randomly selected for a survey involving credit card usage. [2+6]
 - i) Find the prior probability that the selected person is a male.
 - ii) It is later learned that the selected survey subject was smoking a cigar. Also, 9.5% of males smoke cigars, whereas 1.7% of females smoke cigars (based on data from the Substance Abuse and Mental Health Services Administration).
Use this additional information to find the probability that the selected subject is a male.
6. How a knowledge representation is evaluated? Explain semantic net and frame representation with examples. [3+5]
7. Explain all the steps in Fuzzy Learning with block diagram with an example. [8]
8. What are the problem associated with NLP? How syntactic and semantic analysis is done during natural language processing? Explain with example. [3+5]
9. Describe mathematical model of neural network. What does it means to train a neural network? Write an algorithm to its learning. [2+2+4]
10. Write short notes on: [2×4]
 - a) SOM
 - b) Expert Systems

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2081 Baishakh

Exam.	Back		
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. Define intelligent agent. Explain the factors that are required to pass the Turing Test. [2+6]
2. What is well-defined problem? Solve the following crypto arithmetic problem by showing all the steps. [2+6]
LOVE + LOVE = HATE
3. Compare the informed and uniformed search techniques. What strategies can be employed to address the issue of local maxima in Hill Climbing Search? [4+4]
4. Define skolemization with example. Consider the following axioms: [2+6]
 - a) Anyone passing his Engineering exams and winning the lottery is happy.
 - b) Anyone who studies or is lucky can pass all his exams.
 - c) Sneha did not study but she is lucky.
 - d) Anyone who is lucky wins the lottery.By using resolution refutation, prove that Sneha is happy?
5. What is prior probability and posterior probability? A doctor knows that the disease meningitis causes a patient to have a stiff neck, say, 80% of the time. The doctor also knows some unconditional facts: the prior probability that any patient has meningitis is 1/50000, and the prior probability that any patient has a stiff neck is 1%. Determine the probability of meningitis when a patient has a stiff neck. [2+6]
6. Compare semantic net and frame. How you convert semantic net into frame? Explain with example. [3+5]
7. What are different methods for learning? Explain the steps involved in a genetic algorithm with a flowchart and justify why mutation is important. [3+5]
8. What is perception? Construct a Hebbian Network that performs like AND Gate. [2+6]
9. What is expert system? Explain how inference is performed in expert system? [3+5]
10. Write short notes on: [2×4]
 - a) Fuzzy Logic
 - b) Natural Language Processing

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Baishakh

Exam.	Back	
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 an intelligent agent? What type of model it works on? Explain PEAS for a Medical Diagnosis System. [2+2+3]
2. What do you understand by constraint satisfaction problem? Solve the following cryptarithmic problem. EAT+THAT = APPLE [2+6]
3. What are the problem associated with hill climbing search? Explain how simulated annealing overcome problem associated in hill climbing search. [3+5]
4. Assume the following facts:
 - a) Sita likes all kinds of food.
 - b) Momo and Burger are food.
 - c) Anything anyone eats and isn't killed by is food.
 - d) Bill eats mushroom and is still alive.
 - e) Sue eats everything Bill eats.Prove that "Sita likes mushroom" using resolution refutation method. [8]
5. What is Bayesian network? Describe with an appropriate example. How inference can be done using this network? [5+3]
6. What are the different knowledge representation models? Discuss about semantic nets with an example. [2+5]
7. Discuss the steps involved in genetic algorithm with example. [8]
8. What are the problem associated with NLP? How syntactic morphological and semantic analysis is done during natural language processing? Explain with example. [2+5]
9. What are major characteristics of expert system? Explain with example. Explain a general approaches for developing an expert system with a block diagram. [2+5]
10. Write short notes on: [3×4]
 - a) Fuzzy logic
 - b) Computer vision
 - c) A* Search.

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

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Baishakh

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

Subject: - Enterprise Computing (*Elective I*)(CT72507)

- ✓ 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 the Main Frame architecture to the Cloud Computing architecture. Why enterprises are choosing the aspect of cloud computing over other computing models? [3+4]
2. Define enterprise process. Explain major components of enterprise applications and mention mechanism by which enterprise applications at different levels communicate with each other. [2+3+2]
3. What is Service-Oriented Architecture (SOA) and Microservices based Architecture? Are we still using Main Frame architecture? Justify with examples. [2+2+4]
4. IOE plans to host its MIS in the cloud. As a solution Architect, you need to design a system with appropriate components (servers, databases, load balancing, monitoring and notification system e.t.c.). Draw a block diagram by explaining the component that is required while deploying in the cloud. [8]
5. Your client asks you to recommend a storage location where they may upload files, website images, and other content and where those files will remain accessible even in the event of a disaster. Please select a storage option that you think will best meet need after comparing it to other cloud storage options. [4+4]
6. What is Auto Scaling? When do we use it? Explain with an architecture. List down its use cases. [2+2+3]
7. Public, private, and hybrid clouds are three different models of cloud computing technology followed by the companies. Give the scenarios where these can be followed to motivate your customer to use the appropriate models with the examples. [8]
8. Explain shared responsibility model for cloud security. [5]
9. Imagine you are owner of an enterprise, among public and private cloud which will be more economical for your business. Justify. [6]
10. Give an overview of enterprise cloud computing ecosystem. List down its deployment model. [4+3]
11. Write short notes on the following: [3×3]
 - a) Load balancing
 - b) Data mining and its purpose in the enterprise
 - c) Nepalese Government Enterprise Architecture

