

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

**Subject: - Telecommunication (EX703)**

- ✓ 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 digital switching system. Mention functions of switching system in telecommunication. [8]
- ✓ 2. List the types of transmission media. Briefly explain four-wire transmission system and operation of hybrid. [2+6]
- ✓ 3. What is multiplexing? Why pulse stuffing is needed? Explain TDM of analog and digital sources and then show complete TDM PCM system with data rates. [2+2+4]
- ✓ 4. What is multistage switching? Describe the STS switching with neat diagram and its blocking probabilities. [2+6]
- ✓ 5. What are the basic switching functions? Calculate and draw, how many cross points are found in three stage switching system, where as 3 stage, array of 4 input lines and 4 second stages array. [3+5]
- ✓ 6. Why signaling is important in telecommunication system? Briefly explain SS7 protocol stack. [2+6]
- ✓ 7. What are the formulas used in telecommunication traffic engineering decision tree? Describe the blocking formulas uses in finites sources. [4+4]
- ✓ 8. What is pure loss system? Describe the teletraffic Binomial model. [2+6]
- ✓ 9. List the regulation of Nepal Telecommunications Authority. What are the basic charging plan needs for Telecommunication Company? [4+4]
- ✓ 10. Write short notes on: [2×4]
  - a) ADSL
  - b) ISDN

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23 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2071 Chaitra

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

**Subject: - Telecommunication (EX703)**

- ✓ 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.

- ④ 1. With a neat sketch of technical structure of a telephone office, explain the distribution plant. [10]
- ⑥ 2.† What is the difference between two and four wire communication? Describe the four wire communication. [4+6]
- ⑧ 3. Compare and contrast among various multiplexing techniques used in telecommunication. [10]
- ⑧ 4. What are principles of digital exchange? Describe non blocking switches with 3 stages switching matrix. [4+6]
- ⑧ 5. What is signaling in communication system? Explain its forms and types in case of telecom network. [10]
- ⑨ 6. A group of 25 servers carry traffic of 5E. If the average duration of a call is 4 minutes, determine the number of calls put through by a single server and group as a whole in 1 hour. [10]
- ⑥ 7. Explain the purpose, duties and responsibilities of International Telecommunication Union (ITU).
- ⑧ 8. What are the ISDN service connections? Explain. [10]

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- ✓ Attempt All questions.
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1. Explain the role of Logic or digital electronics in upgrading the electromechanical switching system into digital switching system. [7]
2. Describe briefly the advantages of fiber optic cable over the copper cable. Advise suitable application of both the media. [4+3]
3. Explain FDM hierarchy. Describe T carrier system showing the frame structure of T1 level and different multiplexing levels with data rates. [3+5]
4. What are the drawbacks of ST and TS switch and how are they solved by STS switch? Explain. [2+2+4]
5. What is the advantage of common channel signaling system #7 (SS7)? Explain its working principle. [2+5]
6. A public call office (pco) is installed in a busy part of a town. 300 persons use the booth everyday. The average holding time for a call is 5 minutes. There is a suggestion from the public that another pco is required in the same locality as the waiting times are unduly long. Analysis the situation using M/M/1 queue and determine if the suggestion deserves serious consideration. [5]
7. Describe the role of Nepal Telecommunication Authority (NTA) for the development of telecommunication sector in Nepal. [4]
8. Define traffic intensity in telecommunication. Describe the measurement of traffic intensity in terms of CCS, CM and CS. [3+5]
9. What are the advantage and disadvantage of DTMF telephone set? Explain. [8]
10. Write short notes on: (any two) [9+9]
  - i) II<sup>o</sup> Telephone System
  - ii) DSL and ADSL
  - iii) ISDN

Exam.	New Batch (2006 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Telecommunication (EX703)**

- ✓ 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 telephone exchange? Describe the major types of telephone exchanges in brief. [3+4]
2. Define subscribe loop. Explain the subscribe loop system showing cable hierarchy for subscriber loops. [1+5]
3. Explain the European TDM system used in telecommunication system. [7]
4. Explain the working principle of a Digital Telephone Exchange. [10]
5. What Time (T) switch used in digital telephone exchange. [5]
6. Explain the major building blocks or parts used in SS7 network. Show the different links used in SS7 network also. [5+3]
7. Explain the major tasks and goals of traffic engineering in telecommunication along with different types of busy hour defined by CCITT in its recommendation E.600. [3+3]
8. A group of 30 servers carry traffic of 15E. If the average duration of a call is 3 minutes, determine the number of calls put through by a single server and group as a whole in 1 hour. [5]
9. Describe the charging plan used in a telephone network. [4]
10. Write short notes on:
  - a) Nepal Tele Communications Authority (NTA) [4]
  - b) IP Telephony or IP switching or VoIP (voice over internet protocol) [12]
  - c) DSL (Digital Subscriber Line) [6]

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Examination Control Division  
2069 Chaitra

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

**Subject: - Telecommunication (EX703)**

- ✓ 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 Telecommunication. [8]
2. Explain the followings in case of telecommunications:
  - a) Transmission of radio signal in twisted pair and coaxial cable [2]
  - b) The role of characteristic impedance in the flow of radio signal from one equipment to another equipment [2]
  - c) The role of Hybrid transformer or circuit [2]
3. Explain the working principle of TDM. Describe T1 carrier system showing the frame structure and different multiplexing levels. [2+5]
4. Describe the different configurations of a dual processor architecture used in a digital or SPC exchange. [6]
5. What do you mean by S (space) and T (time) switches? Show that 3-stage STS or TST network can minimize the switching problems associated with 2-stage ST or TS network with their working models. [2+6]
6. What is common channel signaling? Explain the working principle of signaling system 7 (SS7). [2+6]
7. In case of telecommunications explain:
  - a) The role of traffic engineering [9]
  - b) Two methods of calculating traffic intensity [6]
8. Write the guidelines for transmission plan defined by CCITT in its recommendation Q.40. [4]
9. What is flow control in data communication network? Explain. [4]
10. Describe the basic services in ISDN with its architecture. [4+4]
11. Explain the operation of ADSL showing modem connection and its topology. [6]

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

**Subject: - Telecommunication (EG772EX)**

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

1. What is a telecommunication? Keeping in view with the evolution of telecommunications, explain the concept of switching system. [2+10]
2. With a block and logical diagram, explain the working principle of space switch (s) used in digital switching system. Justify, why TST switch and why not TS or ST switch are used in digital switching system? [6+6]
3. With a block diagram explain the working principle of a Digital Telephone Exchange. [12]
4. What is a communication protocol and why is it required in data communication? Explain. [12]
5. What is an Ethernet? Keeping in view of CSMA and CSMA/CD explain its working principle. [2+10]
6. Write short notes on: (any two) [10+10]
  - a) Switching techniques in data communication
  - b) Telephone Traffic Engineering
  - c) Routing Algorithm in data communication

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Exam.	Regular	
Level	BE	Full Marks 80
Programme	BEX	Pass Marks 32
Year / Part	IV / 1	Time 3 hrs.

**Subject: - Telecommunication (EX703)**

- ✓ 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 Telecommunication. [8]
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  - a) Transmission of radio signal in twisted pair and coaxial cable [2]
  - b) The role of characteristic impedance in the flow of radio signal from one equipment to another equipment [2]
  - c) The role of Hybrid transformer or circuit [2]
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7. In case of telecommunications explain:
  - a) The role of traffic engineering [9]
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9. What is flow control in data communication network? Explain. [4]
10. Describe the basic services in ISDN with its architecture. [4+4]
11. Explain the operation of ADSL showing modem connection and its topology. [6]

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35 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2068 Bhadra

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

**Subject: - Telecommunications**

- ✓ 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 working principle of time switch and space switch used in digital telephone exchange. What are their drawbacks and how are they solved? Explain. [5+5+4]
2. What are the advantages of DTMF telephone set over conventional pulse dialing telephone set? Explain the design features considered in DTM telephone set. [4+12]
3. Draw a neat diagram of an internet structure and explain the role of repeater, bridge, router and gateway. [4+10]
4. What is communication protocol? Explain the OSI architecture used in data communication. [2+14]
5. Write notes on: (any two) [10+10]
  - a) IBM Ring LAN
  - b) Traffic Engineering
  - c) ISDN

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25 TRIBHUVAN UNIVERSITY  
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**Examination Control Division**  
2065 Magh

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

**Subject: - Telecommunications**

- ✓ 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 traffic engineering and its unit in telecommunication. [12]
2. Why line coding is required before the PCM signals to be connected to the digital line? Justify that Unipolar Non Return to Zero (NRZ), Return to Zero (RZ) and bipolar Alternate Mark Inversion (AMI) codes can not be used in line coding. [4+12]
3. What is space switch? How does it work? Describe the working principle and drawbacks of two stage Space-Time switch. And also explain to solve the drawbacks problem. [2+6+6+6]
4. What is communication protocol and why is it required in data communication? Explain. [1+11]
5. Write short notes on any two of the following: [10+10]
  - a) Digital Telephone Exchange
  - b) Routing Algorithm in Data Communication
  - c) Queuing Theory in Delay System

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

***Subject: - Telecommunications***

- ✓ 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 "talk off" in case of DTMF (Dual Tone Multi Frequencies) telephone set connected in digital exchange? What are the design features considered in making DTMF telephone set to protect from "talk off" problem. Explain. [2+2+12]
2. With the help of a neat diagram, explain the working principle of an Electronic Exchange. [4+12]
3. Why line coding is required in PCM (Pulse Code Modulation) system? Is it possible to implement NRZ (Not Return to Zero), RZ (Return to Zero) and AMI (Alternate Mark Inversion) coding techniques? If not, explain why it is not possible and which coding technique solves this problem? [2+1+8+5]
4. What are the switching techniques in data communication system? Explain. [2+14]
5. Write short notes on any two of the followings: [8+8]
  - a) OSI (Open System Interconnection) Architecture in Data Communication System
  - b) Cambridge Ring LAN
  - c) Hierarchies in Digital Transmission System

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35 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2064 Poush

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

**Subject: - Telecommunications**

- ✓ 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 the difference between DTMF (Dual Tone Multi-Frequency) telephone set and pulse dialing telephone set? Explain the design features of DTMF telephone set. [2+14]
2. With an example, clarify the concept of frame and time slot in case of TDM (Time Division Multiplexing) system. With respect to first order PCM system, explain the mechanism involved in American 24 voice channel multiplex system. [6+10]
3. What is Time (T) Switch? How does it work? Is it possible to make a switching network in a digital exchange with the help of two stage Time-Space (TS) switch? If not, explain why and how this problem is solved. [1+4+1+10]
4. What is protocol and why is it needed in data communication? Explain. [2+10]
5. Write short notes on any two of the following: [10+10]
  - a) Network Topologies and IBM Ring LAN in the data communication
  - b) ETHERNET
  - c) Line coding principles in PCM system

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Exam.	Regular		
Level	BE	Full Marks	40
Programme	BEX, BCT	Pass Marks	16
Year / Part	IV / 1	Time	1 ½ hrs.

**Subject: - Energy Environment and Society (EX701)**

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

1. What is Appropriate Technology? Also explain it in detail.
2. Explain and comment on the current Global and National Energy Scenario.
3. Write down the definition of Insolation, Solar Constant, Irradiance and Peak Sun.
4. What do you understand by wind energy? Write down the factors that determine the available wind energy in any area. Also write down its scope.
5. Write down the potentials and challenges of the hydropower based energy system.

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INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2071 Shawan

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	40
Programme	BEX, BCT	Pass Marks	16
Year / Part	IV / I	Time	1 ½ hrs.

**Subject: - Energy Environment and Society (EX701)**

- ✓ 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 impacts of technology on society? How the appropriate technology helps in the sustainable development of the country? [2+3]
2. Describe the relation between "Human Development Index and Energy Consumption". [4]
3. How do you classify the water turbines? Differentiate between impulse and reaction turbines? [1+2]
4. What is biomass? Describe any thermo-chemical conversion process of biomass? [1.5+2.5]
5. Define beam, diffuse and global radiation and show the relation between them. [3]
6. What are the different economic and environmental advantages of wind and geothermal energy in Nepal? [4]
7. What is fuel cell? How hydrogen fuel cell functions? [3]
8. Explain somatic and genetic effects due to nuclear hazards in human beings. [3]
9. What are the types of batteries? Describe about smart grid system? [2+3]
10. Write short notes on: (any three) [2×3]
  - a) Solar Constant
  - b) Storage of hydrogen
  - c) Global warming
  - d) SO<sub>2</sub> emission and its impact

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23      TRIBHUVAN UNIVERSITY  
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**Examination Control Division**  
 2070 Ashad

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	40
Programme	BEX, BCT	Pass Marks	16
Year / Part	IV / I	Time	1½ hrs.

**Subject:** - Energy, Environment and Society (EX701)

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

1. What do you understand by the term "Appropriate Technology"? [3]
2. What are the conventional and non-conventional energy sources? [3]
3. Write in short about the working of a solar cell. [3]
4. What is a source of hydropower? How can you categorize the hydropower plants? [1+2]
5. What is the major factor determining the availability of wind power? What are the major components of wind turbine? [1+3]
6. What is biomass? Write example of any two different conversion of biomass into fuel. [2+2]
7. Write about battery along with the working principle of any one type. [4]
8. Write briefly about the emission hazard and their impact. [4]
9. Write very briefly your experience on the case study you performed. [2]
10. Define the following briefly: [2×5]
  - a) Technology transfer
  - b) Certified Emission Reduction
  - c) Characteristics curve of solar cell
  - d) Solar dryer
  - e) Classification of hydropower plant

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Exam.	Regular		
Level	BE	Full Marks	40
Programme	BEX, BCT	Pass Marks	16
Year / Part	IV / I	Time	1 ½ hrs.

**Subject: - Energy Environment and Society (EX701)**

- ✓ 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 1. Describe technology transfer and its importance to society and nation. [4]
- ② 2. Explain how development of any country depend upon its energy consumption rate? Explain HDI and compare HDI for Nepal with other developed country with example of energy consumption. [8]
- ③ 3. Discuss the need of energy in each steps of Maslow's hierarchy of needs. [4]
- ④ 4. What are the various biomass <sup>conversion</sup> conservation process? Explain the IV curve for solar photovoltaic cell with temperature variation. How can you have the wind mapping data? Explain in brief. [8]
- ⑤ 5. Write about solar thermal energy and its application. [4]
- ⑥ 6. What is Hydrogen Fuel? Describe about advantages and disadvantages of Hydrogen Fuel. [4]
7. Write short notes on: [4×2]
  - ② i) Hybrid vehicle
  - ④ ii) Smart grid system

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Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	40
Programme	BEX, BCT	Pass Marks	16
Year / Part	IV / I	Time	1½ hrs.

**Subject: - Energy, Environment and Society (EX701)**

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

1. What do you understand by the term "Appropriate Technology"? [3]
2. What are the conventional and non-conventional energy sources? [3]
3. Write in short about the working of a solar cell. [3]
4. What is a source of hydropower? How can you categorize the hydropower plants? [1+2]
5. What is the major factor determining the availability of wind power? What are the major components of wind turbine? [1+3]
6. What is biomass? Write example of any two different conversion of biomass into fuel. [2+2]
7. Write about battery along with the working principle of anyone type. [4]
8. Write briefly about the emission hazard and their impact. [4]
9. Write very briefly your experience on the case study you performed. [2]
10. Define the following briefly: [2×5]
  - a) Technology transfer
  - b) Certified Emission Reduction
  - c) Characteristics curve of solar cell
  - d) Solar dryer
  - e) Classification of hydropower plant

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Exam. <b>New Batch (2066 &amp; Later Batch)</b>			
Level	BE	Full Marks	80
Programme	BEL, BEX, BCI	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Organization & Management (ME708)**

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

1. What are the principles of Organization? Explain the Informal Organization. (4+4)
2. Explain the importance of Management and discuss the different function of Management. (3+5)
3. Explain Administrative Management Theory. (8)
4. What do you mean by organization structure? Explain Line Organization. (4+4)
5. Define the term purchasing. Explain different function of Purchasing department. (3+5)
6. Define the term Personnel management and explain its functions. (8)
7. What do you mean by incentives? Explain the different factors affecting the wage/salary structure. (3+5)
8. Define the term Motivation and explain different technique of motivation. (3+5)
9. Define the term leadership and Explain the different qualities of good leader. (3+5)
- 10 a. Define the term Entrepreneurship. (3)  
b. Explain the Vroom's Expectancy theory of Motivation. (5)
- 11 What do you mean by Case study? Explain the objective of case study. (4+4)
- 12 Define term MIS. How information support for functional areas of management? (3+5)

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Exam.	Regular		
Level	BE	Full Marks	40
Programme	BEX, BCT	Pass Marks	16
Year / Part	IV / I	Time	1½ hrs.

**Subject:** - Energy Environment and Society (EX701)

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

1. What do you mean by appropriate technology? Describe the impact of technology on society. [4]
2. What is the trend of consumption of energy sources in the world? Describe the importance of renewable energy sources? [2.5+2.5]
3. Define E number. How biofuels differ from other sources of energy? [1+3]
4. List out different factors affecting the solar intensity and applications of solar energy. [2+2]
5. What are the minimum constructional requirements to develop a hydropower system? [4]
6. What are the environmental impacts of wind machine? [4]
7. What is fuel cell? How does a solid oxide fuel cell work? [4]
8. The wide spread use of batteries has created many environmental concerns. Describe this concept. [4]
9. Write briefly about the working principle of hybrid vehicles. Also discuss the environment impacts. [2+2]
10. How the energy crisis of our country Nepal can be avoided? Describe its potential solutions in short. [3]

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2069 Chaitra

Exam.	Regular		
Level	BE	Full Marks	40
Programme	BEX, BCT	Pass Marks	16
Year / Part	IV / I	Time	1½ hrs.

**Subject: - Energy, Environment and society (EX701)**

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

1. What is a technology transfer? What impact technology has in your life? [1.5+1.5]
2. What is a clean Development Mechanism (CDM). What are the potential areas of CDM in Nepal? [2+2]
3. What do you understand by solar constant, global irradiation and peak sun? [3]
4. What is geothermal energy? Write down its application. [1+2]
5. Write briefly about briquette and biogas as energy sources in the context of Nepal. [4]
6. What are fuel cells? Explain briefly its working. [4]
7. What are the potential hazard of batteries, How you think this hazard can be prevented? [2+1]
8. What are smart grid and super-capacitor? [2+2]
9. Very briefly give your experience of the case study which you performed. [2]
10. Define the following is not more than three sentences. [2×5]
  - a) Appropriate technology
  - b) HDI
  - c) Solar water heater
  - d) Hydrogen as fuel
  - e) Application of Geothermal Energy

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

**Subject: - Project Management (CT/01)**

- ✓ 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 project? Explain the triple constraints of project with figure. [2+3]
- ✓ 2. What are the essential interpersonal and managerial skills to be a successful project manager? [5]
- ✓ 3. What are the major causes of failure of the ICT project? Describe what bodies of knowledge are required by a PM to contribute for a successful project implementation. [3+4]
3. Consider the below table as the different WBS related job (activity) and sequences as per the project plan for a MIS building project. Times listed are in weeks and the activity network proceeds from 1<sup>st</sup> node to 10<sup>th</sup> node following the table sequences. Draw the critical path network diagram and calculate the total project time and total network slack time of this project. [5+3+3]

Job (activity)	Initial node	Final node	Estimated time
A	1	2	3
B	1	3	2
C	1	4	3
D	2	5	3
E	2	9	2
F	3	5	2
G	3	6	2
H	3	7	3
I	4	7	6
J	4	8	2
K	5	8	3
L	6	9	3
M	7	9	5
N	8	9	5
O	9	10	2

DeMarco states that "you cannot control what you cannot measure". Considering from software project manager's perspective, justify with relevant example?

4. A project manager can modify three basic elements of a software project: the resources available, the time available and the amount of product to be built. Describe how each of these three can be varied during a development process in order to ensure the resulting software is of high quality. [6]
5. Explain about the integrated change control in detail. [6]
6. Suppose you are managing a software development project. The project is expected to be completed in 8 months at a cost of Rs.50,000/- per month. After 2 months, you realize that the project is 30 percent completed at a cost of Rs 200,000/-. Determine whether the project is on-time and on-budget after 2 months. Calculate Cost and Schedule Performance Index. [8]
7. What is difference between communication skills and communication management? How does the communication skill help to resolve conflicts in ICT project? Explain with example. [2+4]
8. Quality is one of the most important factors to be controlled for effective delivery of project objectives. How quality assurance and quality control are implemented in order to deliver a successful project? Describe. [8]
9. Compare the followings: [3×3]
- i) Decision Tree vs. Tornado Analysis for risk management
  - ii) Quotation based purchase vs. Tender based purchase for procurement process
  - iii) Consistency vs. completeness in requirements engineering
10. Write short notes on: [3×3]
- i) Balanced scorecard framework
  - ii) Project management maturity model
  - iii) Responsibility assignment matrix

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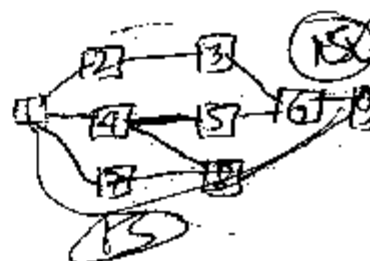
Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Project Management (CI701)**

- ✓ 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.

- Briefly explain the traits of being an effective and ineffective project manager? [2+2]
  - Explain the necessity of IT Project Management? How do you perform feasibility study in IT project? [2+2]
- Explain about knowledge areas of PMI framework. [4]
  - Describe project management? Explain the roles and responsibilities of key project members. [2+2]
- What is a project charter? How do you develop a project charter, explain the inputs and tools and techniques to develop it. [2+5]
- A project work consists of the following activities as listed below in table. [9]

Activity	Description	Duration in days
A (1-2)	Start earth work	3
B (1-4)	Vendor selection	2
C (1-7)	Start handling	1
D (2-3)	Continue earth work	3
E (3-6)	Finish earth work	2
F (4-5)	Ordering raw material	4
G (4-8)	Excavation for drains	6
H (5-6)	Receiving raw material	5
I (6-9)	Base concreting	4
J (7-8)	Continue handling	4
K (8-9)	Laying drains	5



Draw the network diagram and trace the critical path of the network. What are the various timings and the total duration of the above project?

- What do you mean by Project Procurement management and what are the different processes adopted for procurement? [5]
- Explain various tools and techniques for performance reporting. [5]
- If earned value is twice its actual cost for a project, calculate its cost performance index and cost variance percentage. Is the project over/under budget? [6]
- Is there always a tradeoff between quality and productivity? Explain with an IT related example. [3]
  - What are the possible steps to improve project quality? [4]
- What are the essential components of project scope management? Explain. [5]
- Write short notes on: [5×4]
  - Sensitivity analysis
  - The Balanced Scorecard
  - Six sigma
  - Project Management Maturity
  - Decision tree analysis

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

**Subject: - Project Management (CT701)**

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

1. What is a project? List out its characteristics. [2+2]
2. What are different skill sets required by a project manager? Briefly explain each of them. [5]
3. Define project management body knowledge. [2]
4. Explain about Project Management Institute Framework. [4]
5. What are the phases in project life cycle? How does a project life cycle differ from a product life cycle? [5]
6. Explain a Matrix Organization Structure with its advantages and disadvantages. [4]
7. Discuss the concept of project management process groups (PGs). List down two processes of project management process group with their inputs, tools and techniques and output. [4]
8. Explain about Integrated Change Control in IT project development. [5]
9. Why is it important to determine activity sequencing on projects? What are different diagrams/methods that can be used to sequence activities in the project? [5]
10. Given the following information for one-year project, use Earned Value Management (EVM) method to calculate, cost variance, schedule variance, cost performance index (CPI) and Schedule performance index (SPI) for the project. [6]
  - Planned Value = NPR 23,000
  - Earned Value = NPR 20,000
  - Actual Cost = NPR 25,000
  - Budget at Completion = NPR 1,20,000
11. What is a Maturity Model for software development? Explain them. [5]
12. Explain about the necessity of information distribution and its tools and techniques. [5]
13. What are different tools and techniques for risk identification? Discuss brainstorming and Delphi Technique for risk management. [4]
14. What is a procurement process? How is it performed in a project? [1+4]
15. Discuss about IT project management methodology. [5]
16. Write short note on: [2×6]
  - a) Project stakeholders
  - b) Project management information system
  - c) Critical Chain Scheduling
  - d) Categories of Risk
  - e) Balanced Score Card
  - f) Constructive Cost Model (COCOMO)

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BEL, B.Agr.	Pass Marks	32
Year / Part	IV / 1	Time	3 hrs.

**Subject: - Project Engineering (CE701)**

- ✓ 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 a project. Explain the characteristics of project and project life cycle in detail. [2+4+4]
2. Define project appraisal. Write procedure for developing a project proposal. Discuss on techniques of project formulation. [2+4+6]
3. a) Why scheduling is important in planning phase of project? Find all the components of CPM from the following information: [3+13]

S.N	Activity	Duration (days)	Successor
1	A	2	D,E
2	B	5	D,E,H,I
3	C	3	H,I
4	D	4	F,G
5	E	2	G
6	F	4	J
7	G	1	J
8	H	3	J
9	I	2	-
10	J	3	-

- b) Prepare a work breakdown structure and draw simple bar chart of a project which includes at least twelve activities. [3+5]
4. a) What are the factors that cause difficulties in project? [4]
- b) You have a project that is scheduled to be completed in 10 days at a budgeted cost of Rs.1,00,000/-. After the completion of 6 days, you do an analysis and you determined the job is 70% of work is complete and the expenditure is Rs.65,000/-. Based on this data is your work performance is on track? Perform EVA and comment on your own performance. [5]
- c) Define quality. What are the techniques of quality control in a project? [1+4]

**OR**

Explain the relationship between cost, schedule and quality in a project.

5. Why we need analysis of project risk? Explain about sources of risk in a project. What do you mean by qualitative and quantitative risk analysis? [2+4+4]
6. What is capital budgeting decision? Why it is important? A hydropower project costs Rs.30 crore, life is expected to be 40 years and salvage value is Rs.10 crore. Annual income is Rs.6 crore and annual O and M cost is 3% of initial cost. Is it worthwhile to invest if MARR is 10? Use PW and BCR methods to evaluate. [2+2+6]

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

**Subject: - Project Management (CT701)**

- ✓ 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) List out the characteristics of a project. Explain the role of effective feasibility study for the successful completion of a project. [2+2]  
b) What is the role of project manager? What are suggested skills for all project managers and for information technology project managers? [5]
2. a) What is project management institute (PMI)? How is it related to project management? Discuss PMI framework in relation with project management. [4]  
b) Explain with example the concept of drivers of project success and inhibitors of project success. [2+3]
3. a) Discuss the concept of project management process groups (PGs). How is it related to project management knowledge area? Give the example of two processes with necessary inputs, tools and techniques and outputs. [4]  
b) Define work break down structure and its importance in project management. What are different ways/approaches to prepare a work breakdown structure for a project? [5]
4. a) ~~What do you understand by Quality planning, Quality Assurance and Quality Control?~~ Explain different approaches to these processes. [4]  
b) Why better communication management is critical for projects? Discuss the communication management plan that should be considered for ICT projects. [5]
5. a) Explain the integrated change control process in depth. [4]  
b) Define WBS technique in scope management. [3]
6. Being an IT project manager how are you going to manage an IT based project that demands regular updates with new trends in market. [5]
7. Consider you are hired as a consultant in a IT college where every year 50 students are admitted in 4 year program. You are asked to prepare a tender. Specification document for setting up a digital library to be set-up on that college. State your all assumptions that you will be making while preparing the document. [6]
8. If schedule performance index (SPI) is 0.75 in a mega project undergoing near Devikapur district with earned value of being 60. Now calculate the planned value and also state whether the project is ahead schedule or behind schedule. [6]
9. Write short notes on: (any five) [4×5]
  - a) Balanced Scorecard
  - b) Tornado analysis
  - c) Critical path analysis
  - d) Decision tree analysis
  - e) Trends in cloud computing
  - f) Outsourcing and off-shoring options

21      TRIBHUVAN UNIVERSITY  
 INSTITUTE OF ENGINEERING  
**Examination Control Division**  
 2069 Chaitra

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

**Subject: - Project Management (CT701)**

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

1. What is a project, and what are its main attributes? How is a project different from what most people do in their day-to-day jobs? Discuss the specific attributes that are specific to IT related projects. [4]
2. What is a Project Management Body of knowledge? Explain different general management skills necessary to be a good project manager. [2+5]
3. What does it mean by the term "project management practice"? Discuss project management framework as per the standard of Project Management Institute (PMI) along with the concept. [5]
4. What is a Software Development Life Cycle (SDLC)? Explain any one of its kind that you prefer in developing an IT project. Why? [2+5]
5. Most of the project follows functional organizational structure. If you agree, justify. [4]
6. Discuss about Project Management Process Groups. [4]
7. Discuss the process of defining project scope in more detail as a project progresses, going from information in a project charter to a project scope statement, WBS and WBS dictionary. [5]
8. Why is there necessity of Project Time management? Explain how is that performed. [1+4]
9. What is a cost estimating? Explain different tools and techniques used for cost estimating. [1+4]
10. What do you understand by Quality in the context of project management? Discuss quality control process and its major outputs. [5]
11. Why better communication is critical for ICT projects? Discuss the contents of communication management plan that should be considered. [5]
12. What is a Project Risk Management? Explain the processes involved briefly. [5]
13. Why are organization moving towards the trend of outsourcing? Discuss the challenges of outsourcing. [5]
14. What are the roles of award and assessment in achieving Excellency in project completion, Briefly explain. [5]
15. Write short notes on: [3×3]
  - a) Expert Judgement
  - b) Arrow Diagramming Method
  - c) Balance score card

12 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2072 Chaitra

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

**Subject:** - Organization and Management (ME708)

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

- ✓ 1. Why do we need organizations? Describe the principles of an organization. [4+4]
- ✓ 2. State and explain the different levels of Management. What are the basic skills required for Management? [4+4]
- ✓ 3. What is the difference between Scientific Management and Management Science? How do Taylor's principles illustrate importance of Scientific Management for production processes? [3+5]
- ✓ 4. Which organization structure is more suitable to engineering project? Discuss with your logic. [8]
- ✓ 5. Explain the different methods of Purchasing. Why is advertising one of the best form of Marketing? [5+3]
- ✓ 6. What is the difference between recruitment and hiring? Why do we need incentives in an organization? [4+4]
- ✓ 7. What are the different factors that affect wage / salary structure? Explain different methods of Training Manpower. [4+4]
- ✓ 8. What is the difference between theory 'X' and theory 'Y'? Explain on the basis of different theory of motivation. [8]
- ✓ 9. Describe Autocratic Leadership Style. Explain the different characteristics of Entrepreneur. [3+5]
- ✓ 10. If you are asked to prepare the case study considering the planning horizon, leadership, motivation and human resource development for either Nepal Electricity Authority or Nepal Telecom to improve the existing performance of these institution. How do you prepare case study following its structure? [8]

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12 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2071 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	IV / 1	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.

- ⑦ 1. Why is an organization necessary? Explain the principles of an organization. [4+4]
- ⑫ 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]
- ⑥ 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]
- ⑦ 4. What do you mean by purchasing and procurement? Explain the functions of marketing. [3+5]
- ⑥ 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]
- ⑦ 6. Define the term job analysis and explain scientific selections of manpower. [5+3]
- ⑥ 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]
- ⑤ 8. A reader is leader. Elaborate it in terms of leadership styles. What are the differences between a leader and a manager? [5+3]
- ⑦ 9. Define Management Information System (MIS). Describe briefly about different types of Information System and their support to managers in decision making. [5+3]
- ⑦ 10. What are the objectives of a case-study? Explain the needs, functions and importance of MIS. [3+5]

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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 / 1	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 personnel management. [3+5]
7. Define merit rating. State and describe the various methods of merit rating. [2+6]
8. What do you mean by human needs? Describe A. Maslow's hierarchy of needs theory in detail. [3+5]
9. Define leadership and explain by Blakes and Mouton's Management Grid. [3+5]
10. Define Management Information System. Explain information support for functional areas of management. [2+6]

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<b>Exam.</b>	<b>Old Back (2065 &amp; Earlier Batch)</b>		
<b>Level</b>	BE	<b>Full Marks</b>	80
<b>Programme</b>	BEJ, BEX, BCT	<b>Pass Marks</b>	32
<b>Year / Part</b>	IV / I	<b>Time</b>	3 hrs.

**Subject:** - Organization and Management (EG709ME)

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

1. a. What do you mean by single ownership? Explain the Importance of Organization in Society. (3+5)
- b. What are the functions of Management? Explain the system theory of management. (4+4)
2. a. What do you mean by Marketing? Explain different manufacturing method. (3+5)
- b. Define the term industrial relation. Explain authority and responsibility. (3+5)
3. a. Define the term MIS. Explain the hierarchy of information architecture. (3+5)
- b. What do you mean by networking information system? Explain the role of computer for information system. (3+5)
4. a. Define the term Motivation and explain McGregor's Theory "X" and "Y" of motivation. (3+5)
- b. What do you mean by incentive? Explain behavioral approach of leadership. (3+5)
5. a. Define the term Job analysis. Explain different method of performance appraisal. (3+5)
- b. What do you mean by hiring and selecting staff? Explain different steps of hiring and selecting staff. (3+5)
6. Write short notes on Any Four (4\*4)
  - a. Contingency theory of management
  - b. Single ownership organization
  - c. Needs for MIS
  - d. Informal organization
  - e. Collective Bargaining

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

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17 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2068 Baishakh

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

**Subject: - Organization and Management**

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

1. What is meaning of organization? Explain organization behavior as a multidisciplinary field. Explain the Scientific Management theory. [4+4+8]
2. What do you understand by policy and executive groups in an organization? Explain functional organization. What is responsibility and authority? Explain matrix organization chart. [4+4+3+5]
3. Why is MIS necessary for management? Explain computer and MIS. What is information Architecture? Explain database information system. [4+4+3+5]
4. Explain the two factors theory of motivation. How can you determine the most effective leadership style? Define the term informal organization. [5+7+4]
5. Define the term personnel management. Explain the different factors of wage and salary structure. What are the methods of performance appraisals? [4+8+4]
6. Write short notes on: (Any Four) [4×4]
  - a) Leadership style
  - b) Information system for planning process
  - c) Marketing concept
  - d) Database information system
  - e) Incentive programs

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17      TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2067 Ashadh

Exam.	Regular/Back		
Level	RE	Full Marks	60
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

***Subject: - Organization and Management***

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

1. Differentiate between private limited and public limited company. Explain organization behaviour as a multidisciplinary field. What are the importance of contingency theory of management? [5+4+7]
2. What do you mean by purchasing and marketing concept? Explain the manufacturing methods in industrial organization. What do you mean by span of control in a line organization? [5+6+5]
3. Explain the importance of management information system. Discuss the role of information in the planning process. What do you mean by network information system? [5+6+5]
4. Discuss the Herzberg's theory of motivation. How will you determine the most effective leader in the business organization? Define the term informal organization. [6+6+4]
5. Explain the term job description. What are the processes of collective bargaining? Discuss the different steps of hiring and selecting staff. [4+6+6]
6. Write short notes on: (any four) [4×4]
  - a) Partnership organization
  - b) Industrial relation
  - c) Job design and work efficiency
  - d) Functional organization
  - e) Computer integrated manufacturing plants

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## Examination Control Division

2066 Bhadra

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

**Subject: - Organization and Management**

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

1. What do you mean by organization behaviour? Explain the functions of management. Discuss the behavioural management theory. [4+4+8]
2. Discuss the activities of production development. What do you mean by industrial relation? Define the term line and staff organization. [5+6+5]
3. Discuss the hierarchy of information needs. What are the role of information system for decision making process? Explain database information system. [5+6+5]
4. What are the motivational theory of Herzberg's hygiene factors and motivational factors? Discuss the behavioural approach of leadership. Define the term authority and power. [6+5+5]
5. What do you mean by job analysis? Discuss the different steps of hiring and selecting staff. Explain the methods of performance appraisal. [6+5+5]
6. Write short notes any four of the following: [4×4]
  - a) Contingency Management Theory
  - b) Needs for Management Information System (MIS)
  - c) Contingency Approach of Leadership
  - d) Incentive Programs
  - e) Value of Case Study

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16 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2065 Shrawan

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

**Subject: - Organization and Management**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
  - ✓ Attempt any Five questions.
  - ✓ The figures in the margin indicate Full Marks.
  - ✓ Assume suitable data if necessary.
- 
1. What do you mean by organization? Explain the importance of organization in society. Discuss the concept of scientific management theory. [3+5+8]
  2. Explain different activities of production development. What do you mean by purchasing? Define the term responsibility and authority. What do you mean by span of control? [5+3+5+3]
  3. What do you mean by hierarchy of needs? Define the term information architecture. Discuss the term information system for planning process. Explain the database information system. [4×4]
  4. Define the term theory 'X' and theory 'Y' in the motivation theory. Justify job design improve work efficiency. What do you mean by trait approach in leadership? Discuss the importance of participative management in organization. [5+3+4+4]
  5. What do you mean by personal management? Define the term job analysis. Discuss deferent steps of hiring and selecting staff. What do you mean by collective bargaining?[3+5+5+3]
  6. Write short notes any four of the following: [4×4]
    - a) Single ownership organization
    - b) Industrial relation
    - c) Networking information system
    - d) Informal organization
    - e) Needs of MIS

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Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	IV / 1	Time	3 hrs.

**Subject: - Organization and Management**

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

1. Define the term organization. Explain organization as an open system. What do you mean by management? Explain different function of management. [3+5+3+5]
2. What do you understand by division of labour? Define term span of control. Explain the term authority and responsibility. [4+4+8]
3. What is the contribution of computer in management information system? Explain the role of software to on-line information system for planning process. [7+9]
4. Explain different styles of leadership in brief. Which style you recommend as most effective leader in industrial organization? [10+6]
5. What do you mean by human resource management? Define the term collective bargaining. Explain the process of collective bargaining. [5+5+8]
6. Write short notes any four of the following: [4×4]
  - a) Scientific management theory
  - b) Industrial relation
  - c) Maslow's hierarchy of needs theory
  - d) Information system model
  - e) Job analysis

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

***Subject: - Organization and Management***

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

1. Define the term management and discuss the concept of Taylor's scientific management theory.
2. What do you mean by organization structure? Explain the meaning of responsibility and authority.
3. What do you mean by hierarchy of information needs? Explain the information system for planning process.
4. Define the term 'Motivation'. How does Macgregor's theory 'X' and theory 'Y' apply to motivation?
5. What do you mean by job analysis? Explain different steps of hiring and selecting staff.
6. Write short notes any two of the following:
  - a) Transactional Management Model
  - b) Objective of Purchasing
  - c) Networking Information System

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17 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2063 Ashwin

<b>Exam.</b>		<b>Back</b>	
<b>Level</b>	BE	<b>Full Marks</b>	80
<b>Programme</b>	BEL, BEX, BCT	<b>Pass Marks</b>	32
<b>Year / Part</b>	IV / I	<b>Time</b>	3 hrs.

***Subject: - Organization and Management***

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

1. Explain the concept of management in an organization and describe the level of management in details.
2. Is there a need for leadership? Explain what provides the power of leaders over their followers. Describe leadership styles in brief.
3. What motivates people at work? Describe the Maslow's hierarchy need and compare with that of Herzberg.
4. Describe the importance of hiring procedure in an organization and explain the steps of hiring in details.
5. What is case study? Explain in details of steps involve in the case study.
6. Write notes on (any three)
  - a) Organization
  - b) Market Structure
  - c) The Concept of Management Information System
  - d) Business Process and Information System

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16/2-4 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2062 Baishakh

Exam.	Level	Regular/Back	
		Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
	Year / Part	Time	3 hrs.

***Subject: - Organization and Management***

- ✓ Candidates are required to give their answers in their own words as far as practicable.
  - ✓ *Attempt any Five questions.*
  - ✓ *All questions carry equal marks.*
  - ✓ *Assume suitable data if necessary.*
1. Define the terms organization and management. What is a closed system? Explain organization as a open system.
  2. What do you mean by production development? Explain different activities of the production development function.
  3. What do you mean by information architecture? Explain information system for planning process.
  4. What do you mean by leadership? Explain different leadership theories you are familiar with.
  5. Define the term personnel management and explain different methods of performance appraisal.
  6. Write short notes any two of the following:
    - a) Behavioural Management Theory
    - b) Industrial Relation
    - c) Participative Management

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1602-5

TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2061 Baishakh

Exam.	Regular / Back		
Level	B.E.	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Organization and Management**

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

- 1/ What do you mean by management? Explain the different models of management.
- 2/ Define the term marketing and explain the importance of marketing management.
3. What is the contribution of computers for the management information system? Explain networking information system.
- 4/ What do you mean by participative management? Explain the role of informal organization in management.
- 5/ What do you mean by collective bargaining? Explain the different process of collective bargaining.
- 6/ Write short notes any two of the following:
  - a) Joint Stock Company
  - b) Information Architecture
  - c) Incentive Programs

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16 / 1-3 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2058 Chaitra

Exam.	Regular / Back		
Level	B.E.	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

***Subject: - Organization and Management***

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

1. Define the term 'Management' and explain the various function of management.
2. What do you mean by organizational structure? Explain the salient features of line and staff organization.
3. What is the contribution of computers for the management information system? Explain the importance of networking information system.
4. Define the term 'Motivation' and explain the Maslow's hierarchy of needs.
5. What do you mean by salary structure and explain the different factors of wage and salary structure?
6. Write short notes on any two of the following:
  - a) Joint Stock Company
  - b) Informal Organization
  - c) Information Architecture

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167-16 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2059 Chaitra

Exam.	Regular / Back		
Level	B.E.	Full Marks	80
Programme	BEL, BEX, BCI	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Organization and Management**

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

1. "People dominated not by individual but by organization", comment.

✓ 2. Define the term policy and executive group and explain the managerial function.

✓ 3. What is the contribution of computers in the management information system? Explain an importance of networking information system.

✓ 4. Define the term motivation and explain the theory of Maslow's hierarchy of needs.

✓ 5. What do you mean by collective bargaining and explain the different process of collective bargaining?

6. Write short notes any two of the followings:

- ✓ a) Authority and power
- ✓ b) Information system model
- c) Case study

16/12-23 TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2057 Chaitra

Exam.	Regular / Back		
Level	B.E.	Full Marks	80
Programme	BEL/BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hr

*Subject: - Organization and Management*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any Five questions.
- ✓ All questions carry equal marks.

1. Discuss the concept of Elton Mayo's human relation movement.
2. Define the term "purchasing" and explain the relation between marketing management and purchasing procedure.
3. What do you mean by management information system? Explain the hierarchy of information needs.
4. Describe the term "Authority and Power". Explain the sources of power in the organization.
5. What do you mean by performance appraisals and explain the different methods of performance appraisals.
6. Write short notes on any two of the followings.
  - a) Organization behaviour
  - b) Integrated approach to leadership
  - c) Job description

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Examination Control Division  
2072 Chaitra

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

**Subject: - Communication System II (EX702)**

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

- ✓ 1. If a source emits symbols  $X_i = \{A, B, C, D, E, F\}$  in the BCD format with
  - ✓ a) Probabilities  $P(X_i) = \{0.3, 0.1, 0.02, 0.15, 0.4, 0.03\}$  at a rate  $R_s = 14.4$  Kbaud, find the following: [5]
    - i) Information rate
    - ii) Coding efficiency both with BCD and Huffman coded signal
  - ✓ b) Explain Huffman codes with examples. [4]
- ✓ 2. State Nyquist sampling theory. Determine the Nyquist rate and Nyquist interval for a continuous time signal  $x(t) = 6\cos 50\pi t + 20\sin 300\pi t - 10\cos 100\pi t$  is to be sampled and quantize using 512 levels. [2+5]
- ✓ 3. Explain E1 digital hierarchy as related to telephony system. Evaluate the expression of SQNR in uniformly quantized PCM system. [4+4]
- ✓ 4. Explain Shannon channel capacity theorem. Write down theoretical limitations of this theorem. [2+3]
- ✓ 5. a) Define Inter Symbol Interference (ISI) in baseband digital communication system. Explain the ideal and practical solution for zero ISI. [2+6]
  - ✓ b) Represent binary sequence 1001001101 in polar, NRZ, polar RZ, Manchester and AMI codes. [4]
- ✓ 6. What do you understand by optimum detection? Show that the impulse response of the optimum detector network is the time shifted replica of the incoming signal. [2+5]
- ✓ 7. Find the error probability in coherent ASK and PSK detections and show that ASK requires double the average signal power than PSK for same error probability. [4+3]
- ✓ 8. Explain the modulator, demodulator and signal space diagram for FSK Modulation. [6]
- ✓ 9. With necessary derivation, compare noise performance of DSB-Am, DSB-SC, SSB-SC. [8]
- ✓ 10. Define Hamming weight and Hamming distance for a code vector  $x = (0111000)$  and the parity check matrix  $H$  given below: Prove that, the given code is valid. [2+4]

$$H = \begin{bmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}_{3 \times 7}$$

- ✓ 11. Write short notes on: (any two) [5]
  - i) Noise Equivalent Bandwidth
  - ii) M-ary baseband data communication
  - iii) Eye Diagram

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

**Subject: - Communication System II (EX702)**

- ✓ 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 source coding in digital communication system. A discrete memory less source emits four symbols with probabilities  $P = \{0.125, 0.125, 0.25, 0.5\}$ . If the output symbols are encoded using Shannon Fano code, find the Coding efficiency and compare the coding efficiency with that of BCD code. [2+4+2]
2. State Nyquist sampling theory. Determine the Nyquist rate and Nyquist interval for a continuous time signal  $x(t) = 6\cos 50\pi t + 20\sin 300\pi t - 10\cos 100\pi t$  is to be sampled and quantize using 512 levels. [2+5]
3. Explain E1 digital hierarchy as related to telephony system. Evaluate the expression of SQNR in uniformly quantized PCM system. [4+4]
4. Why is DPCM superior over PCM? Explain its working principle with necessary figures and equations. [2+5]
5. What is Shannon's channel capacity theorem? Write down theoretical limitations of this theorem. [1+3]
6. State Nyquist Criteria for zero ISI in both time and frequency domain. What are two major difficulties with duo binary encoding method and explain how can they be solved? [3+6]
7. Represent binary sequence 1001001101 in polar, NRz, polar RZ, Manchester and AMI codes. [4]
- 8/ Define moment and central moment of continuous random variable. Show that first central moment is always zero. Determine the noise equivalent bandwidth of RC-LPF and that of ideal LPF of zero frequency response one. Also, find output noise power of this RC-LPF when input is white noise. [5+1]
9. What do you mean by optimum detector? Find the impulse response of optimum detector in the presence of additive white noise. [1+6]
10. Derive the expression for evaluating the gain parameter  $(SNR_o/SNR_i)$  of non-coherent FM detector. [8]
11. With necessary assumption, derive the expression for bit error probability for binary ASK system. [6]
- 12/ Define Hamming weight and Hamming distance for a code vector  $x = (0111000)$  and the parity check matrix  $H$  given below. Prove that, the given code is valid. [2+4]

$$H = \begin{bmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}_{3 \times 7}$$

Exam.	Old Back (2065 & Earlier Batch)		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Communication System II (EG732EX)**

- ✓ 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. State Nyquist sampling theory? Why sub-sampling is done in digital communication? Explain the effects of deviation that arises because of practical sampling as compared with ideal sampling. [1+2+3]
2. What do you mean by Pulse Code Modulation? Differentiate between uniform quantization and non-uniform quantization. [3+5]
3. Explain the operation of Differential PCM along with its derivations and diagram. Draw the staircase approximation diagram using delta modulation for the data 1111000010101010. [6+2]
4. An analog signal bandlimited to 10 KHz is sampled at Nyquist rate and quantized in 8 levels with probabilities of  $1/4, 1/5, 1/5, 1/10, 1/10, 1/20, 1/20, 1/20$  respectively. Calculate the entropy and the information rate. [8]
5. What do you mean by duo-binary encoding? What is its importance? Explain duo-binary encoding with example. [4+4]
6. Draw the spectrum and Auto-correlation function with the necessary derivation for the White Noise passed through the a RC low pass filter. [8]
7. What is the significance of Noise Equivalent Bandwidth in communication system? Derive the expression for Noise Equivalent Bandwidth for the case of Bandpass filter. [4+4]
8. What is detector gain? Prove that for 100% modulation of DSB-AM, the detector gain is less than 1. [2+6]
9. Why pre-emphasis and deemphasis networks are used in FM system? Explain. [8]
10. Write short notes on: [4×2]
  - a) Convolution coding
  - (b) Distortion

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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

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

**Subject: - Communication System II (EX702)**

07/01/0

- ✓ 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. Elaborate importance of source encoder? Write algorithm for Huffman's coding. [2+3]
2. What are the practical factors to be considered while sampling? Explain. If two band limited signals  $X_1(t)$  and  $X_2(t)$  have bandwidths of  $W_1$  and  $W_2$  Hertz respectively, estimate the maximum sampling interval required for the signal given by  $Y(t) = X_1(t) X_2(t)$ . [6+2]
3. What are the signalling (bit) rate and bandwidth requirement for the T1 and E1 digital carrier systems? Explain briefly about Differential Pulse Code Modulation (DPCM) encoder. [3+4]
4. Define PMA, PWM and PPM with corresponding waveforms. A Television signal having a bandwidth of 4.8MHz is transmitted using binary PCM system. Given that the number of quantization levels is 512. Determine: [1.5+1+1.5+1.5]
  - i) Code word length
  - ii) Transmission bandwidth
  - iii) Final bit rate
  - iv) Output signal to quantization noise ratio
5. Derive the expression for evaluating signal to quantization noise ratio (SQNR) for Delta modulation. [6]
6. Represent binary sequence 1011001010 in Polar NRZ, Polar RZ, Manchester and AMI codes. [4]
7. Explain the Modulator, Demodulator and Signal Space Diagram for QPSK modulation with relevant derivations. [8]
8. Differentiate between message and information? A discrete source is emitting one of 5 possible symbols per 10 Microsec. The probabilities are  $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}$  and  $\frac{1}{16}$ . Find (a) Symbol rate (b) Source entropy (c) Information rate [2+3]
9. Explain the approximation of the matched filter for a rectangular pulse using an Ideal low pass filter with variable bandwidth. [6]
10. Derive the expression for evaluating error probability in binary communication system? What is threshold effect in FM? How it can be minimized? [7+3]
11. The generator polynomial of a (7,4) cyclic code is  $g(x) = 1+x+x^3$ . Find the code for the message vector 1011 in a non-systematic and systematic form. [6]
12. Write short notes on:
  - a) Linear prediction theory/coding [6]
  - b) White noise and its psdf [2]

Exam.	Old Back (2065 & Earlier Batch)		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Communication System II (EG732EX)**

- ✓ 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. State and prove sampling theorem with relevant derivation. [8]
2. Prove that for every extra bit used in representatin of quantization level the SQNR of uniform quantization will increase by 6 db. [8]
3. Differentiate between FDM and TDM. Explain about the T1 telephony hierarchy. [4+4]
4. An analog signal bandlimited to 4 Khz is sampled at Nyquist rate. The samples are quantized into 4 levels. Each level represent one symbols. Thus there are 4 symbols. The probabilities of occurrence of these 4 levels are  $P(x1)=P(x4)=1/8$  and  $P(x2)=P(x3)=3/8$ . Obtain information rate of the source. [8]
5. Explain about the Nyquist pulse shaping criterion for zero Inter-symbol Interference of baseband digital communication. [8]
6. What is the significance of Noise Equivalent Bandwidth in communication system? Derive the expression for Noise Equivalent Bandwidth for the case of Bandpass filter. [4+4]
7. Derive the expression for impulse response of a matched filter. Why matched filter is preferred in pulse digital communication system? [6+2]
8. Prove that for 100% modulation of DSB-AM, the detector gain is less than 1. [8]
9. Explain about the threshold effect in detection of Frequency Modulation using limiter discriminator detector. [8]
10. What is the speciality of Binary Cyclic codes in linear block coding? Explain its properties. [8]

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

**Subject: - Communication System II (EX702)**

- ✓ 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 source coding? Develop Huffman coding of a 5 symbol source with probabilities:  $S_0 = 0.3$ ,  $S_1 = 0.25$ ,  $S_2 = 0.2$ ,  $S_3 = 0.15$ ,  $S_4 = 0.1$ . And also calculate Coding efficiency. [1+3+1]
2. a) With mathematical derivation show that original band limited signal band limited signal can be reconstructed from its samples taken at Nyquist rate. [5]  
b) What is aliasing effect and how it can be minimized? [3]
3. a) Find the signal to quantization noise ratio in Uniform Quantization in term of no of bits per source sample. [8]  
b) Explain functional block diagram of the PCM system. Find the signaling rate of the  $T_1$  system and draw its frame diagram. [3+3]
4. a) Define Information and Entropy. Calculate the upper limit of the channel capacity as the bandwidth of the channel  $B$  tends to infinity. [2+4]

**OR**

State Nyquist pulse shaping criteria for Zero ISI. Discuss any one pulse shaping method of ISI reduction.

- b) A discrete source emits one of 6 possible symbols per  $10\mu s$  in statistically independent manner. The symbol probabilities are  $\frac{1}{4}$ ,  $\frac{1}{4}$ ,  $\frac{1}{4}$ ,  $\frac{1}{8}$ ,  $\frac{1}{16}$  and  $\frac{1}{16}$  respectively. Calculate symbol rate, entropy and information rate. [6]
5. a) What is DPSK and how it can be implemented? [4]  
b) What is modem? Discuss the modes of operation of modems. [4]
6. a) Define noise equivalent bandwidth. Find mean and AC function at the output when a WSSP signal is passed through the LTI system. [3+5]  
b) Realize the matched filter with relevant mathematical support. [4]
7. a) What is capture effect? Calculate the gain parameter in DSB-FC with envelop detection. [2+5]  
b) Compare AM and FM in terms of power efficiency, band width efficiency and system complexity. Calculate the error probability of coherent ASK. [3+4]
8. a) Define Hamming Weight and Hamming Distance. [2]  
b) What is binary Cyclic Code? Construct a (7,4) Cyclic Code using a generator polynomial:  $g(x) = x^3 + x^2 + 1$  with data vector 1011. [1+4]

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

**Subject: - Communication System II (EX702)**

- ✓ 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 advantages of Digital Communication System as compared to analog communication system? Elaborate the importance of Source and channel encoders in Digital communication system. [2+3]
2. What do you mean by aperture effect in Sampling? How can it be corrected? A band pass signal with the spectrum in the range of (80-115) KHz is to be digitized, Calculate minimum sampling frequency required for the signal. [5+3]
3. Explain the E1 digital hierarchy. A speech signal with maximum frequency of 4 KHz and maximum amplitude of  $\pm 1.1$  V is applied to a PCM system with its bit rate of 32 Kbps. Calculate the SQNR and number of bits per sample. [4+3]
4. What do you mean by companding. Why is it necessary? Explain different types of companding methods. [3+4]
5. A signal of bandwidth 4.5 KHz is sampled at the double rate given by Nyquist, the signal is quantized in 8 levels, the probability of occurrence of the level are 0.1, 0.15, 0.15, 0.05, 0.2, 0.05, 0.18, 0.12. Find the minimum no of bits per sample and information rate. [4]
6. What is ISI? Explain two practical methods of minimizing ISI. [2+6]
7. Explain FSK modulation with its modulator, demodulator and signal space diagrams. [8]
8. What do you mean by random process? Explain White noise with its PSDF and Auto correlation function. [4]
9. Derive the expression for error probability for binary PAM system and extend it to M-ary system. [6+2]
10. Explain the threshold effect in non coherent detection of FM signal. How can it be corrected? [4+3]
11. Derive the expression of error probability for coherent detection of Amplitude Shift Keying (ASK). [6]
12. Write notes on: [8+1]
  - a) The eye diagram
  - b) Syndrome calculation in linear systematic block code.

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

**Subject: - Communication System II (EX702)**

- ✓ 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.

- What are the advantages of Digital Communication System as compared to analog communication system? Elaborate the importance of Source and channel encoders in Digital communication system. [2+3]
- What do you mean by aperture effect in Sampling? How can it be corrected? A band pass signal with the spectrum in the range of (80-115) KHz is to be digitized, Calculate minimum sampling frequency required for the signal. [5+3]
- Explain the EI digital hierarchy. A speech signal with maximum frequency of 4 KHz and maximum amplitude of  $\pm 1.1$  V is applied to a PCM system with its bit rate of 32 Kbps. Calculate the SQNR and number of bits per sample. [4+3]
- What do you mean by companding. Why is it necessary? Explain different types of companding methods. [3+4]
- A signal of bandwidth 4.5 KHz is sampled at the double rate given by Nyquist, the signal is quantized in 8 levels, the probability of occurrence of the level are 0.1, 0.15, 0.15, 0.05, 0.2, 0.05, 0.18, 0.12. Find the minimum no of bits per sample and information rate. [4]
- What is ISI? Explain two practical methods of minimizing ISI. [2+6]
- Explain FSK modulation with its modulator, demodulator and signal space diagrams. [8]
- What do you mean by random process? Explain White noise with its PSDF and Auto correlation function. [4]
- Derive the expression for error probability for binary PAM system and extend it to M-ary system. [6+2]
- Explain the threshold effect in non coherent detection of FM signal. How can it be corrected? [4+3]
- Derive the expression of error probability for coherent detection of Amplitude Shift Keying (ASK). [6]
- Write notes on: [8]
  - The eye diagram
  - Syndrome calculation in linear systematic block code.

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

**Subject:** - Communication System II

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

1. State and explain merits of digital communication systems. Discuss the significance of channel encoder and channel modulator in DCS. (4+6)
2. Explain any two issues (considerations) that have to be taken care of while sampling continuous time signals. A earthquake data recorder traces the signals that changes its polarity a maximum of thirty times each 10 sec. Estimate the Nyquist sampling frequency and the data rate if this signal is to be converted into a 10 bit PCM signal. (6+4)
3. Define quantization. A signal having the dynamic range of  $\pm 5$  V is to be uniformly quantized to 128 representation levels. Estimate the required step size, the power of quantization noise produced and the maximum signal to quantization noise ratio that can be achieved. (4+6)
4. Differentiate between information and entropy. Derive the expression for the entropy of a source that emits M non-equiprobable symbols in statistically independent manner. (4+6)
5. Derive the mathematical expression of the signal at the input of the receiver of a baseband digital communication system and based on that expression, define Inter-Symbol Interference (ISI). State and explain Nyquist Pulse shaping criteria for zero ISI. (6+4)
6. Define bit error probability and bit error rate. Derive the expression for evaluating bit error probability for a binary channel with additive Gaussian noise. (4+6)
7. Derive the general expression for the impulse response of a matched filter when the shape of the signal to be detected is  $z(t)$ . (10)
8. Write notes on (5+5)
  - a. Performance evaluation of DCS using Eye diagram
  - b. Cyclic codes

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

**Subject: - Communication System II**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
  - ✓ Attempt All questions.
  - ✓ The figures in the margin indicate Full Marks.
  - ✓ Assume suitable data if necessary.
1. What are the basic building blocks of a digital communication system? Explain each block briefly. State, with examples, the advantages and disadvantages of digital communication system. [2+4+4]
  2. State sampling theorem. Illustrate that the original bandlimited signal  $x(t)$  with frequency spectrum  $X(f)$  can be reconstructed from its samples taken at Nyquist or higher rate. [4+6]
  3. Define quantization and indicate its use in communication. Prove that the maximum signal to quantization noise ratio (SQNR) for liner quantization is limited by  $(4.8+6n)$  dB, where 'n' is the number of bits used to represent each quantized sample value. [4+6]
  4. Define information and entropy. A source that emits one of 5 different symbols per micro-second in a statistically independent manner with the probabilities 0.3, 0.25, 0.2, 0.125 and 0.125 respectively. Calculate the entropy and the information rate of the source. [4+6]
  5. Verify that the output of a Linear Time Invariant system is also a wide sense stationary process (WSSP) if the input to it is a WSSP. [10]
  6. State Shannon-Hartley channel capacity theory. Discuss its implications with examples. A communication channel with additive white Gaussian noise and power spectral density of  $10^{-10}$  W/Hz over the entire frequency range has the permissible bandwidth of 16 kHz. The minimum required input signal power to the receiver is 0.45 mW. Estimate the capacity of this channel. [2+4+4]
  7. Derive the general expression for evaluating error probability in binary baseband system with PAM. Compare binary and M-ary systems in terms of data speed, required channel bandwidth and error probability. [6+4]
  8. Write notes on: [5+5]
    - a) Threshold effect in WBFM
    - b) Syndrome calculations in linear block coding

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

**Subject: - Communication System II**

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

1. ✓ Compare digital and analog communication systems. Draw functional block diagram of DCS and explain the significance of channel encoder and source encoder. (4+6)
2. ✓ State and explain Nyquist sampling theorem. A signal  $x(t) = 10 \cos(2\pi 2000 t) + 4 \cos(2\pi 3000 t)$  is to be sampled and quantized using 256 levels, calculate the minimum sampling frequency and sampling period. (6+4)
3. ✓ Derive the expression for evaluating signal to quantization noise ratio (SQNR) for uniform quantization in terms of number of quantization levels and number of bits per source sample. (10)
4. ✓ Explain the basic principle of TDM. Discuss T1 and E1 hierarchy of TDM-PCM telephony. (4+3+3)
5. ✓ Define information and entropy. Relate the message, the entropy and the information. (6+4)
6. ✓ Derive the expression for evaluating error probability in binary baseband system with additive Gaussian noise in the channel. (10)
7. ✓ Derive the expression for the impulse response of a matched filter when the input excitation is  $z(t)$ . (10)
8. ✓ Write brief notes on: (5+5)
  - a. Noise equivalent bandwidth
  - b. Convolutional coding

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

Subject: - Communication System II

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

1. State and explain Nyquist sampling theorem. A bandlimited bandpass signal centered at 40 MHz and having total bandwidth of 60 KHz is to be sampled, calculate the minimum sampling frequency. Chap. 1 [6-4]
2. Find the expression for evaluating SQNR for the case of uniform quantization. Discuss any one of companding techniques used in non-uniform quantization. Chap. 2 [6-4]
3. State and explain Shannon's channel capacity theorem for binary channel. Derive the expressions for theoretical limits of this theorem. Chap. 3 [6-4]
4. Define white noise? Find its autocorrelation function. Explain RC filtering of white noise with necessary derivation. Chap. 4 [2-2-6]
5. Derive the expression for evaluating error probability for the case of binary symmetric channel with additive white noise. Chap. 5 [10]
6. Derive the expression for impulse response of matched filter. Chap. 4 [10]
7. A (7, 4) non systematic cyclic code generator polynomial has the form  $g(x) = 1 + x^2$ . Find the code words for message blocks (1101) and (0010). Chap. 6 [5+5]
8. Write notes on: [5+5]
- a) Convolution Coding Chap. 6
- b) Eye Diagram Chap. 8

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Chap 1 - 10 marks  
2 - 10 "  
3 - 15 "  
4 - 20 "  
5 - 10 "  
6 - 15 "

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

**Subject: - Communication System II**

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

1. State sampling theorem. What are aliasing and aperture effects in sampling? Find the expression for signal to quantization noise ratio (SQNR) in PCM. [1+2+5]
2. Define entropy. Derive the expression for evaluating the entropy of source emitting symbols in statistically independent manner. A discrete source emits three symbols with probabilities 1/3, 1/6 and 1/2. Find source entropy. [1+3+4]
3. Define Inter Symbol Interference (ISI). State Nyquist pulse shaping criteria for zero ISI. Briefly explain Duo-binary encoding method. [2+2+4]
4. Derive the expression for the impulse response of a matched filter. [8]
5. Prove that the output of the LTI system is wide sense stationary process (WSSP) if its input is WSSP. [8]
6. Derive the expression for error probability for M-ary system. [8]
7. Derive the expression for evaluating the gain parameter ( $SNR_o/SNR_i$ ) of FM detector. [8]
8. Compare PCM and differential PCM. [3+5]

A linear delta modulator is designed to operate on speech signals limited to 3.4 KHz. The specifications of the modulator are as follows:

- \* Sampling rate =  $10.f_N$ , where  $f_N$  is the Nyquist rate of the speech signal.
- \* Step size  $\Delta = 100$  mV

The modulator is tested with a 1 KHz sinusoidal signal. Determine the maximum amplitude of this test signal required to avoid slope overload.

9. The generator polynomial of a (7,4) cyclic code is  $g(x) = 1 + x + x^3$ . Find the code vector for the message vector 1011 in non-systematic and systematic form. [8]
10. Write notes on: [4+4]
  - a) Eye diagram
  - b) Linear prediction theory

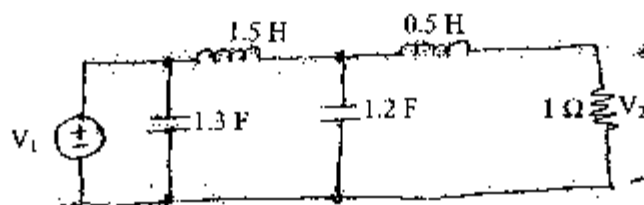
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Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Filter Design (EX704)**

- ✓ 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 tables are attached herewith.
- ✓ Assume suitable data if necessary.

- ✓ 1. What is the significance of normalization and de-normalization in filter design? The following is a pass filter with  $\omega_p = 1$  rad/sec. Modify the circuit so that it becomes a low pass filter with a pass band of 1000 rad/sec and a load resistance of 75  $\Omega$ . [2+3]



- ✓ 2. Derive an expression to calculate the order of Inverse Chebyshev low pass filter. Use this formula to estimate the order of Inverse Chebyshev low pass filter having following specification: [5+3]

$$\alpha_{\max} = 0.25 \text{ dB}, \quad \omega_p = 1000 \text{ rad/s}$$

$$\alpha_{\min} = 18 \text{ dB}, \quad \omega_s = 1400 \text{ rad/s}$$

- ✓ 3. What is delay equalization? How can it be done? Explain with necessary figures. [5]
- ✓ 4. What are the applications of Frequency Transformation in Filter Design. How can you obtain a high pass filter from a given low pass filter? Explain with a suitable example. [6]
- ✓ 5. Which of the following is LC lossless function and why? Pick one of the valid LC lossless functions and synthesize it using Foster and Cauer methods. [2+3+3]

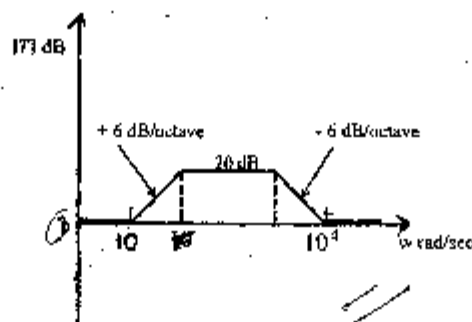
i)  $Z_1(s) = \frac{s(s^2 + 4)(s^2 + 9)}{(s^2 + 2)(s^2 + 10)}$

ii)  $Z_2(s) = \frac{(s^2 + 2)(s^2 + 10)}{s(s^2 + 5)}$

iii)  $Z_3(s) = \frac{s^2 + 25}{s(s^2 + 5)(s^2 + 50)}$

- ✓ 6. Define transmission zeros. How zeros of transmission be realized? Explain with suitable example. [5]

7. Design a third order Butterworth low pass filter using resistively terminated lossless ladder with unequal termination.  $R_1 = 1\Omega$  and  $R_2 = 4\Omega$  (Refer table 1) [7]
8. Realize the following transfer function by cascading two first-order sections using inverting op-amp configuration. [5]
- $$T(s) = \frac{12}{s^2 + 8s + 12}$$
9. Design Sallen key lowpass filter for fourth order Butter worth filter. The final circuit should have  $\omega_0 = 10,000$  rad/s have and practically realizable elements. (Refer table 1). [8]
10. What information do you get when the sensitivity of x with respect to y is -5? Perform sensitivity analysis for center frequency ( $\omega_0$ ) of the Sallen Key low pass filter with respect to all the resistors and capacitors present in the circuit. [1+4]
11. Draw the circuit diagram of an generalized impedance converter. Derive the relationship between input and output current. How can it be used to simulate a grounded FDNR? Explain. [5]
12. Design a Fourth order Butterworth low pass filter having half power frequency of 4000 rad/s using Frequency dependent negative resistor (FDNR). (Use table 2) [6]
13. What is switched capacitor filter? Design a switched capacitor filter to realize the magnitude response given below: [1+6]



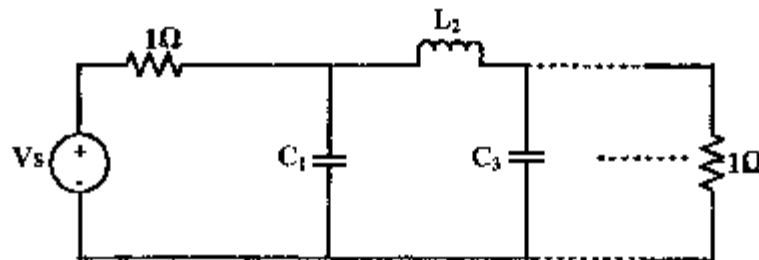
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Table 1:  
Pole Location for Butterworth Responses

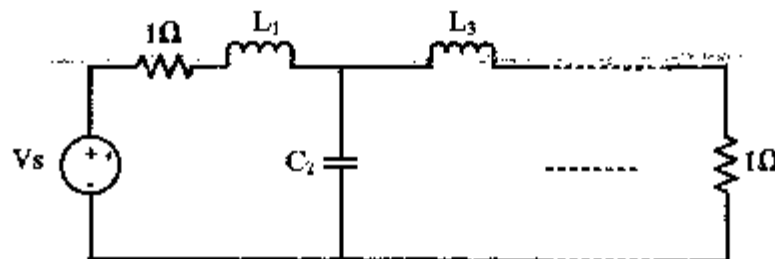
n=2	n=3	n=4	n=5
- 0.7071068 $\pm j 0.7071068$	- 0.50 $\pm j 0.86603$	- 0.3826834 $\pm j 0.9238795$	- 0.809017 $\pm j 0.5877852$
	- 1.0	- 0.9238795 $\pm j 0.3826834$	- 0.309017 $\pm j 0.9510565$
			-1.0

Table 2:

Elements values for doubly terminated Butterworth filter normalized to half power frequency of 1 rad/s



n	$C_1$	$L_2$	$C_3$	$L_4$	$C_5$
2	1.414	1.414			
3	1	2	1		
4	0.7654	1.848	1.848	0.7654	
5	0.618	1.618	2	1.618	0.618
n	$L_1$	$C_2$	$L_3$	$C_4$	$L_5$



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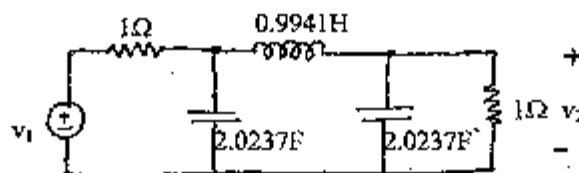
Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Filter Design (EX704)**

- ✓ 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 the significance of scaling in filter design? Derive the necessary expressions to determine the new values of circuit elements in the case of magnitude and frequency scaling. [6]
2. Derive an expression to calculate the order of Inverse Chebyshev low pass filter. Use this formula to estimate the order of Chebyshev low pass filter having following specifications: [5+3]
 

$\alpha_{\max} = 0.25 \text{ dB}, \quad \omega_p = 1000 \text{ rad/s}$   
 $\alpha_{\min} = 18 \text{ dB}, \quad \omega_s = 1400 \text{ rad/s}$
3. Explain the importance of all pass filters in delay equalization. Find the transfer function of fourth order Bessel-Thomson low pass filter. [3+3]
4. What is the importance of frequency transformation in filter design? The circuit given in figure below is a lowpass filter having passband frequency of 1 rad/s. Obtain a band pass filter having  $\omega_0 = 2000 \text{ rad/s}$  and  $B = 400 \text{ rad/s}$ . [2+3]



5. Which of the following functions are LC driving point impedance function and why? [2+3+3]

$$Z(s) = 2 \frac{s(s^2 + 4)(s^2 + 16)}{(s^2 + 1)(s^2 + 9)}$$

$$Z(s) = 4 \frac{(s+2)(s+5)}{(s+1)(s+4)}$$

Also find the Foster series and Cauer II Realization of the valid LC driving point impedance function.

6. What is transmission zeros? Explain "zero shifting by partial removal of pole" with example. [1+4]

7. What is transmission coefficient? What information do we get from it? Derive expression for reflection coefficient for a resistively terminated LC ladder circuit. [2+5]
8. Realize a system using inverting op-amp configuration with zero at  $s = -2$  and pole at  $s = -5$  and having high frequency gain of 2. [3]
9. Perform sensitivity analysis for center frequency ( $\omega_0$ ) and quality factor (Q) of the Tow Thomas low pass filter with respect to all the resistors and capacitors present in the circuit. [5]
10. What is Frequency Dependent Negative Resistor? How can it be used to avoid bulky inductors in the design of your circuits? Explain with suitable examples. [5]
11. Using heapfrag method simulate the LC ladder circuit given in question number 4 to obtain a low pass filter having passband of 6KHz and suitable element values. [6]
12. What is switched capacitor filter? How inverting lossy integrator, integrator and non-inverting integrator can be realized using switched capacitor? Explain with necessary diagrams and transfer functions. [7]
13. Draw a neat and clean circuit diagram of Tow-Thomas Low Pass Biquad filter and derive its transfer function. Design a low pass filter using Tow-Thomas Biquad circuit which has poles at  $1000 \pm j8994.03$  and DC gain of 1.89. Use  $0.01 \mu\text{F}$  capacitor in your design. [9]

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Exam. Level	Regular	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / 1	Time	3 hrs.

**Subject: - Filter Design (EX704)**

- ✓ 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 tables are attached herewith.
- ✓ Assume suitable data if necessary.

1. Define  $\alpha_{\max}$ ,  $\alpha_{\min}$  and half power bandwidth with necessary diagrams. At frequency  $f = 20$  KHz and  $f = 30$  KHz a filter is designed to attenuate the input signal by 78 dB and 90 dB respectively. Find the amplitude of the output signal if the 30 KHz input signal has amplitude of 1V. [3+4]
2. Derive an expression to calculate the order of Chebyshev low pass filter. Use this formula to estimate the order of Chebyshev low pass filter having following specification:  
 $\alpha_{\max} = 0.1$  dB,  $\omega_p = 1000$  rad/s  
 $\alpha_{\min} = 20$  dB,  $\omega_s = 2500$  rad/s [5+3]
3. What is constant delay filter? What are the steps involved in designing constant delay filter? Explain with necessary example. [6]
4. What is the significance of frequency transformation in filter design? How band pass filter can be obtained from prototype low pass filter? Explain with example. [1+3]
5. Which of the following functions are LC driving point impedance function and why? Pick one of the valid LC driving point impedance and synthesize it in Foster-I and Cauer-I form:  
 $Z_1(s) = \frac{(s^2 + 1)(s^2 + 5)}{(s^2 + 2)(s^2 + 10)}$   $Z_2(s) = \frac{5s(s^2 + 4)}{(s^2 + 1)(s^2 + 3)}$  [2+3+3]  
 $Z_3(s) = \frac{2(s^2 + 1)(s^2 + 9)}{s(s^2 + 4)}$   $Z_4(s) = 4 \frac{(s + 2)(s + 5)}{(s + 1)(s + 4)}$
6. What is transmission zeros? What are the steps involved in realizing transmission zeros of a lossless two port network? Explain with suitable example. [5]
7. What is reflection coefficient? Design a third order Butterworth high pass filter using resistively terminated lossless ladder with equal termination of  $1\Omega$ . (Refer following table). [1+6]

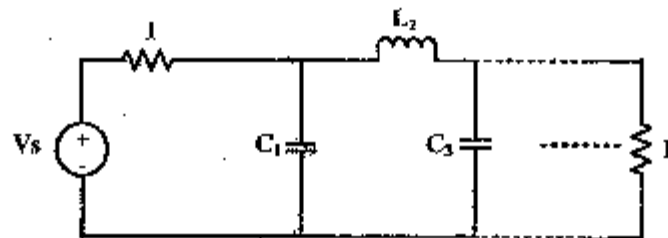
Table Location for Butterworth Responses

n=2	n=3	n=4	n=5
- 0.7071068 $\pm j 0.7071068$	- 0.50 $\pm j 0.86603$	- 0.3826834 $\pm j 0.9238795$	- 0.809017 $\pm j 0.5877852$
	- 1.0	- 0.9238795 $\pm j 0.3826834$	- 0.309017 $\pm j 0.9510565$
			- 1.0

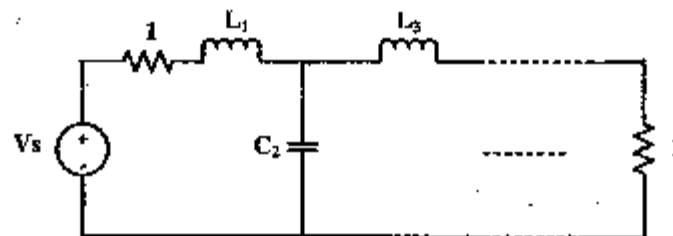
8. Draw the circuit diagram and derive transfer function of Tow Thomas Biquad circuit. Design a low pass filter using Tow-Thomas Biquad circuit with poles at  $-500 \pm j 2449.49$  and dc gain of 2. The final circuit should consist capacitors of value  $0.1\mu F$ . [3+5]

9. What is RC-CR transformation? Draw the circuit diagram of high pass sellen-key biquad obtained by RC-CR transformation of its low pass counterpart. [4]
10. What is signal parameter sensitivity? Perform sensitivity analysis for center frequency ( $\omega_0$ ) of Sallen-Key biquad with respect to all resistors and capacitors present in the circuit. [1+4]
11. What is GIC? How a GIC can be used to simulate grounded inductor? Explain with necessary figures and expression. [5]
12. Simulate third order Butterworth low pass filter using Leapfrog simulation. (Refer following table) [6]

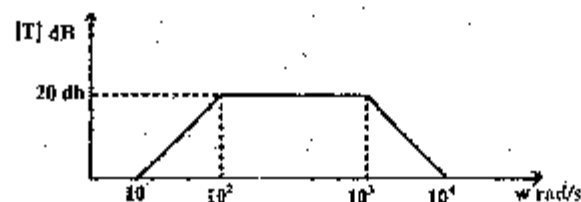
Elements values for doubly terminated Butterworth filter normalized to half power frequency of 1 rad/s



n	$C_1$	$L_2$	$C_3$	$L_4$	$C_5$
2	1.414	1.414			
3	1	2	1		
4	0.7654	1.848	1.848	0.7654	
5	0.618	1.618	2	1.618	0.618
n	$L_1$	$C_2$	$L_3$	$C_4$	$L_5$



13. What is switched capacitor filter? What are its applications? Design a switched capacitor filter to realize the magnitude response given below: [2+5]



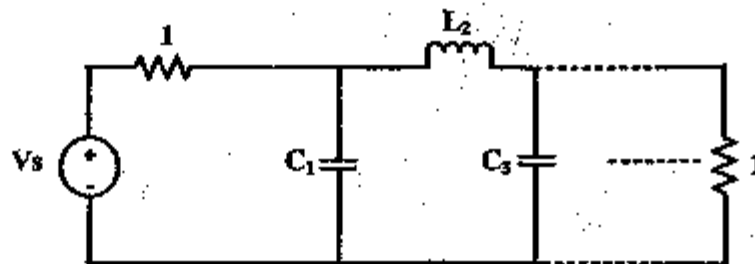
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Table 1:  
Pole Location for Butterworth Responses

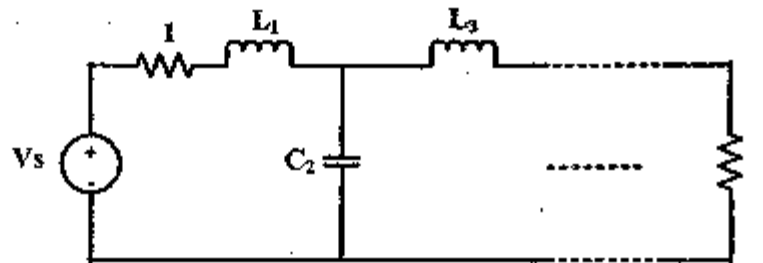
n=2	n=3	n=4	n=5
- 0.7071068	- 0.50	- 0.3826834	- 0.809017
+ j 0.7071068	+ j 0.86603	+ j 0.9238795	+ j 0.5877852
	- 1.0	- 0.9238795	- 0.309017
		+ j 0.3826834	+ j 0.9510565
			- 1.0

Table 2:

Elements values for doubly terminated Butterworth filter normalized to half power frequency of 1 rad/s



n	C <sub>1</sub>	L <sub>2</sub>	C <sub>3</sub>	L <sub>4</sub>	C <sub>5</sub>
2	1.414	1.414			
3	1	2	1		
4	0.7654	1.848 <sup>o</sup>	1.848	0.7654	
5	0.618	1.618	2	1.618	0.618
n	L <sub>1</sub>	C <sub>2</sub>	L <sub>3</sub>	C <sub>4</sub>	L <sub>5</sub>



Filter design - J. Chaitra.

Box IV (1)

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

**Subject: - Filter Design (EX704)**

- ✓ 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 the importance of Normalization and Denormalization in filter design? Derive element scaling equations. [2+5]
2. Derive the expression to calculate the order of Butterworth approximation for given lowpass filter specifications. Calculate the order of Butterworth low pass filter having following specification; [3+3]
  - i) Passband extends from  $\omega = 0$  to  $\omega = 200$  rad/s and the attenuation in the passband should not exceed 0.1 dB.
  - ii) Stopband extends from  $\omega = 2000$  rad/s to  $\omega = \infty$  and the attenuation in the stopband should not be less than 30 dB
3. What is a constant delay filter? Find the transfer function of a third order Bessel Thomson response having constant delay. [2+4]
4. What is frequency transformation? Describe the frequency transformation from low pass to band stop filter with example. [4]
5. Which of the following functions are LC driving point impedance function and why? [4+3]
 
$$Z(s) = \frac{s(s^2 + 4)}{(s^2 + 9)(s^2 + 16)}, \quad Z(s) = \frac{s(s^2 + 1)(s^2 + 9)}{(s^2 + 4)(s^2 + 16)}$$

$$Z(s) = \frac{s(s^2 + 4)}{2(s^2 + 1)(s^2 + 9)}, \quad Z(s) = \frac{2(s + 1)(s + 3)}{(s + 2)(s + 4)}$$

Also find the Cauer II realization of the valid LC driving point impedance function.
6. What is "zero shifting by partial removal of pole"? Explain with example. Also mention its importance in two port network synthesis. [4+2]
7. What is transmission coefficient? What information do you get from the transmission coefficient? Design a second order Butterworth low pass filter using lossless ladder with equal termination of  $1\Omega$  i.e.  $R_1 = 1\Omega$  and  $R_2 = 1\Omega$  (Refer Table I) [1+1+5]
8. Draw the circuit diagram of Tow thomas biquad low pass filter and derive its transfer function. Design a second order low pass filter using Tow Thomas biquad circuit having poles at  $-750 \pm j 661.44$  and dc gain of 2. Use capacitor of value  $0.01\mu F$  in your design. [8]

9. Design the following transfer function using inverting op-amp configuration.

[4]

$$T(s) = 7 \frac{s+400}{s+200}$$

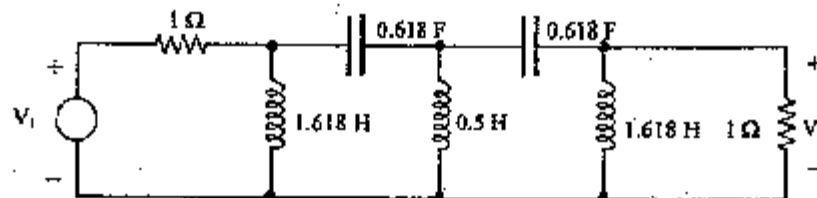
— You are not allowed to use inductors in the design.

10. What do you understand when the sensitivity of  $y$  with respect to  $x$  is equal to -3? Perform sensitivity analysis for Quality factor  $Q$  of the Tow Thomas low pass filter with respect to all the resistors and capacitors present in the circuit.

[1+4]

11. What is generalized impedance converter (GIC)? How can you simulate the grounded inductor in the passive filter using GIC? Explain. The following circuit is a high pass filter having half power frequency of 1 rad/sec. Design a high pass filter having half power frequency of 4.5 kHz by active simulation of inductors. In your final circuit the largest capacitance should be 0.1  $\mu$ F.

[2+4+6]



12. What is a switched capacitor filter? What are its applications? How can you simulate a resistor using switched capacitor? Explain with necessary derivation.

[3+3]

Table 1: Pole Location for Butterworth Responses

$n=2$	$n=3$	$n=4$	$n=5$
-0.7071068	-0.50	-0.382684	-0.809017
$\pm j 0.7071068$	$\pm j 0.86603$	$\pm j 0.9238795$	$\pm j 0.5877852$
	-1.0	-0.9238795	-0.309017
		$\pm j 0.3826834$	$\pm j 0.9510565$
			-1.0

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

**Subject: - Filter Design**

- ✓ 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 tables are attached herewith.
- ✓ Assume suitable data if necessary.

1. The magnitude squared function of Chebyshev approximation is given as: [4+2+4]

$$|T_n(j\omega)|^2 = \frac{1}{1 + \epsilon^2 C_n^2(\omega)}$$

- a) Derive an expression to calculate the required order for given low pass filter specifications.
  - b) Calculate the required order for following low pass specifications.  
 $\alpha_{\max} = 0.5 \text{ dB}$ ,  $\alpha_{\min} = 14 \text{ dB}$ ,  $\omega_p = 1200 \text{ rad/s}$ ,  $\omega_s = 1800 \text{ rad/s}$
  - c) Prove that the locus of poles of Chebyshev approximation is ellipse.
2. Which of the following functions are LC-driving point impedances? Explain with reason. [4]

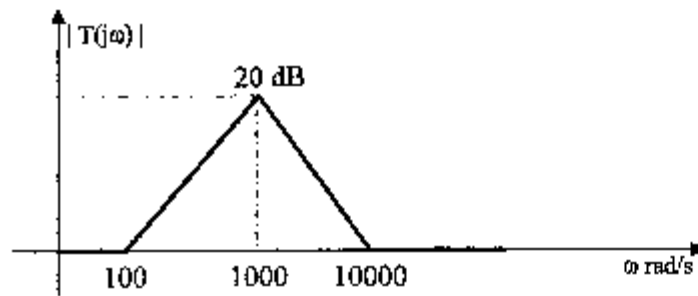
$$Z_1(s) = \frac{s^2 + 20s^3 + 64s}{s^4 + 34s^2 + 225}, \quad Z_2(s) = \frac{s^4 + 9s^2 + 8}{s^3 + 4s}$$

Synthesize one of the realizable impedance using Cauer-I and Cauer-II method. [3+3]

3. For  $R_1 = R_2 = 1\Omega$ , obtain a lossless ladder to realize the following transmission coefficient: [10]

$$t(s) = \frac{2(s^2 + 1)}{3s^3 + 4s^2 + 3s + 2}$$

4. Draw the neat diagram of Sallen-Key low pass filter and derive the transfer function. Design a fourth order Butterworth filter (refer Table 1) using cascade of two Sallen-Key circuits using design-1 and design-2 respectively. Your final circuit must have cutoff frequency of  $\omega_0 = 4000 \text{ rad/s}$  and capacitances of  $0.1 \mu\text{F}$  to  $0.001 \mu\text{F}$ . [10]
5. Define bandwidth,  $\alpha_{\max}$ ,  $\alpha_{\min}$  and roll off with necessary diagram. At frequency  $f = 15 \text{ kHz}$  and  $f = 20 \text{ kHz}$  a filter is designed to attenuate the input signal by 78 dB and 90 dB respectively. Find the amplitude of the output signal if the 15 kHz input has amplitude of 500 mV. [8]
6. What is the importance of frequency transformation in filter design? Use frequency transformation to find the bandstop filter assuming suitable lowpass prototype. [8]
7. Discuss single parameter and multiparameter sensitivities. Perform the sensitivity analysis of Sallen-Key lowpass filter. [8]
8. What is frequency dependent negative resistor (FDNR)? How FDNR helps us to avoid the use of inductor in filter design? Explain with suitable example. [8]
9. What is switched capacitor filter and what are the limitations? Design a switched capacitor MOS filter to realize the magnitude response given in attached figure. [8]



Use suitable clock frequency for your design.

**Table 1:**  
Pole Locations for Butterworth Responses

$n = 2$	$n = 3$	$n = 4$	$n = 5$
-0.7071068 $\pm j 0.7071068$	-0.50 $\pm j 0.86603$	-0.3826834 $\pm j 0.9238795$	-0.809017 $\pm j 0.5877852$
	-1.0	-0.9238795 $\pm j 0.3826834$	-0.309017 $\pm j 0.9510565$
			-1.0

\*\*\* The End \*\*\*

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

**Subject: - Filter Design**

- ✓ 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 table is attached herewith.
- ✓ Assume suitable data if necessary.

1. Define bandwidth, transition width,  $\alpha_{\max}$ ,  $\alpha_{\min}$  and roll off. [6]

2. What are the major properties of RC driving point impedance functions? [4+2+3+3]

$$Z_1(s) = \frac{s^2 + 4s + 3}{s^2 + 8s + 12}, \text{ and } Z_2(s) = \frac{s^2 + 8s + 12}{s^2 + 4s + 3}$$

Determine which of the above impedance function is valid RC driving point impedance?  
Then realize it in Foster series and RC ladder form.

3. Explain zero shifting by partial removal of pole with a suitable example. [6]

4. Derive relation to estimate the order  $n$  of inverse Chebyshev approximation. Use this formula to estimate the order of inverse Chebyshev for following specifications: [4+3+5]

$$\alpha_{\max} = \alpha_p = 1 \text{ dB} \quad \alpha_{\min} = \alpha_s = 16 \text{ dB}$$

$$\omega_p = 1000 \text{ rad/s} \quad \omega_s = 1600 \text{ rad/s}$$

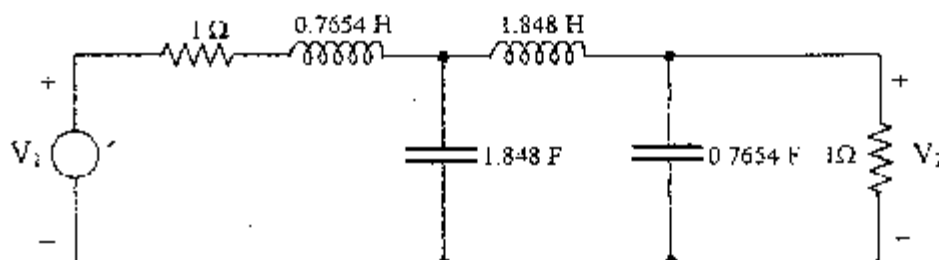
Determine the pole locations and plot it.

5. Starting from a second order all pole transfer function  $t(s) = \frac{a_0}{s^2 + a_1s + a_2}$ , derive the constant delay second order filter. [8]

6. How can you transform given low pass filter into a bandpass filter? Explain with example. [6]

7. Draw the complete circuit of Sallen Key low pass biquad filter and derive the transfer function. Design third order lowpass Butterworth filter at  $f_0 = 3 \text{ kHz}$  using Sallen and Key circuit. Your final circuit must contain practically realizable values. Perform gain compensation if necessary. [6+6]

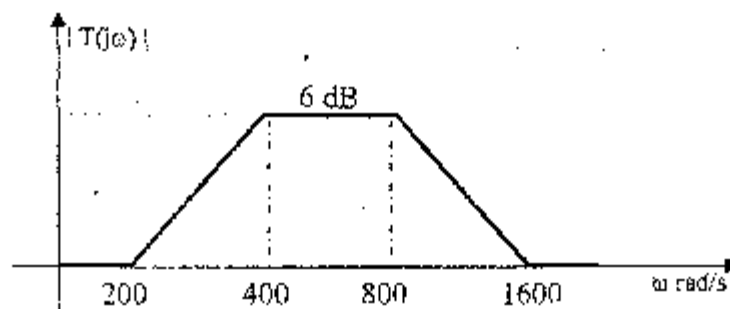
8. Design a lowpass filter using the Leapfrog simulation method. The prototype is given in figure below, having half-power frequency of  $1.0 \text{ rad/s}$ . [10]



In your final design the half-power frequency is to be  $1.6 \text{ kHz}$ , and all elements should be in a practical range of values.

9. Design a switched capacitor MOS filter to realize the magnitude response given below:

[8]



Use suitable clock frequency for your design.

\*\*\*

**Table 1:**  
Pole Locations for Butterworth Responses

$n = 2$	$n = 3$	$n = 4$	$n = 5$
$-0.7071068$	$-0.50$	$-0.3826834$	$-0.809017$
$\pm j 0.7071068$	$\pm j 0.86603$	$\pm j 0.9238795$	$\pm j 0.5877852$
	$-1.0$	$-0.9238795$	$-0.309017$
		$\pm j 0.3826834$	$\pm j 0.9510565$
			$-1.0$

Exam.	Old Back (2065 & Earlier Batch)		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Filter Design (EG675EX)**

- ✓ 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.

- What are the differences between ideals and practical filter? Describe the concept of  $\alpha_p$  and  $\alpha_s$  with diagrams. [2+2]
  - Derive element scaling equations. What is the importance of scaling? Explain. [6]
- What are the properties of Butterworth approximation? What are its advantages and disadvantages compared with other approximation methods? Explain. [2+2]
  - Find the order of Butterworth low pass filter and plot its pole-zero locations which satisfies the following specifications:  $\alpha_{\max} = 1$  dB,  $\alpha_{\min} = 12$  dB,  $\omega_p = 1000$  rad/s,  $\omega_s = 2000$  rad / s [6]
- Define positive real function. What are the properties of RC impedance function? Explain. [6]
  - Realize the given function below using faster I method [5]
$$Y(S) = \frac{(S^2 + 1)(S^2 + 5)(S^2 + 20)}{s(S^2 + 2)(S^2 + 10)}$$
- What is zero-shifting by partial pole removal? Explain with example. [4]
- Find the relationship between transmission coefficient and reflection coefficient in case of doubly terminated lossless two port network. [4]
  - Give the reflection coefficient,  $\rho(s)$  below, realize the doubly terminated lossless two port with resistances of 1 Ohm each.  $\rho(S) = \frac{S^3}{S^3 + 2S^2 + 2S + 1}$ . [5]
- Draw the circuit diagram of low Thomas biquad circuit and derive its transfer function. Design a second order lowpass filter using Tow Thomas biquad circuit with poles  $-2000\pi \pm j4852.58$  and a dc gain of 2. In your final design, use capacitor of  $0.01\mu\text{F}$ . [4+6]
- Define single parameter and multi-parameter sensitivity. Why sensitivity analysis is important in filter design? [2+2]
  - Perform the sensitivity analysis of Tow Thomas Biquad circuit. [5]
- What is Generalized Impedance Converter (GIC)? Discuss the active simulation of grounded inductor with example. [2+8]
- What is switched capacitor filter? Realize the switched capacitor circuit of integrator, inverting summer, lossy integrator and inverting integrator. [7]

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

**Subject: - Filter Design**

- ✓ 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 properties of RC admittance function? Determine whether the following functions are RC admittance functions or not? [12]

$$Y(s) = \frac{s^3 + 3s}{s^4 + 5s^2 + 4}$$

$$Y(s) = \frac{s^2 + 4s + 3}{s^2 + 2s}$$

$$Y(s) = \frac{(s+1)(s+3)}{(s+2)(s+4)}$$

Realize one of the valid RC admittance function using Foster parallel and Cauer II method.

2. Draw the neat and clean circuit diagram of Tow Thomas biquad circuit and derive the low-pass transfer function. How can you obtain highpass response from Tow Thomas biquad circuit? Explain with necessary derivations. Using Tow Thomas biquad circuit realize the following transfer function [12]

$$T(s) = \frac{2000}{s^2 + 500s + 1000000}$$

3. Derive the expression to estimate the order (n) of Inverse Chebyshev approximation. Use this formula to estimate the order of Chebyshev filter for following specifications: [8]

$$\omega_p = 1000 \text{ rad/s} \quad \omega_s = 1500 \text{ rad/s}$$

$$\alpha_p = 1.0 \text{ dB} \quad \alpha_s = 15.0 \text{ dB}$$

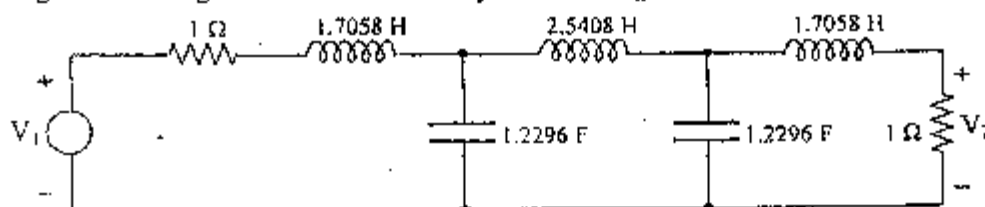
4. Define the terms: pass-band, stop-band, half-power point, roll-off, insertion-loss and insertion-gain with necessary diagrams. [8]

5. What are the properties of lossless two port network? If a pole is removed partially from given impedance function, what is the effect on all poles and zeros in given impedance function? Explain with example. [8]

6. What are the characteristics of active filter? Realize an active filter using inverting op-amp configuration with zero at 8, pole at 4 and dc gain of 2. [8]

7. What is sensitivity? Compare the sensitivity of active vs. passive filter. Perform sensitivity analysis of Tow Thomas biquad lowpass filter. [8]

8. Following circuit shows the passive lowpass filter having normalized bandwidth. Design a lowpass filter using FDNR having bandwidth of 4 kHz. In your final design all elements should be in practical range. [8]



9. What is switched capacitor filter? How a resistor can be simulated using switched capacitor? Explain. [8]  
Also draw the switched capacitor equivalent circuit of the Summing inverter and Non-inverting integrator.

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

**Subject: - Filter Design**

- ✓ 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 tables are attached herewith.
- ✓ Assume suitable data if necessary.

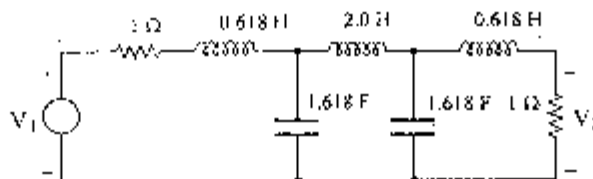
1. What are the advantages of active filter over passive filter? Realize a bilinear transfer function with zero at 3, pole at 9 and high frequency gain of unity using inverting op-amp configuration. [8]
2. Derive the element scaling equations. What is the importance of normalization in filter design? Explain with example. [8]
3. Synthesize the following impedance function in Foster parallel and Cauer II form. [8]

$$Z(s) = \frac{6s^4 + 54s^2 + 48}{s^5 - 19s^3 + 48s}$$

4. Realize a two port LC ladder circuit which is defined by following impedances: [12]

$$Z_{11} = \frac{s^2}{s(s^2 + 10)} \text{ and } Z_{22} = \frac{s^2 + 5}{s(s^2 - 10)}$$

5. Following circuit is a fifth order Butterworth lowpass filter at normalized frequency. From given circuit obtain a highpass filter having half power frequency of 10 KHz using simulated inductors. [8]



6. Draw the circuit diagram of multiple feed-back (MFB) lowpass biquad filter, and derive its transfer function. Design the second order Butterworth lowpass filter having half power frequency of 10 KHz using MFB biquad circuit. In your final circuit, the largest capacitance should be 0.1 uF. [12]
7. Define sensitivity? What is single parameter and multiparameter sensitivity? Why passive filters are less sensitive than active filters? Explain. Perform sensitivity analysis of RLC lowpass filter. [8]
8. From a doubly terminated fourth order Butterworth lowpass filter, design a lowpass filter having half power frequency of 4000 rad/sec using active simulation of inductors. [8]
9. What is switched capacitor filter? How can you simulate a resistor and invert a signal using switched capacitor? Explain with necessary derivations. [8]

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Table 1: Pole locations for Butterworth Response

$n = 2$	$n = 3$	$n = 4$
$-0.7071068 \pm j 0.7071068$	$-0.50 \pm j 0.86603$	$-0.3826834 \pm j 0.9238795$
	$-1.0$	$-0.9238795 \pm j 0.3826834$

Table 2: Elements of 4<sup>th</sup> order Butterworth lowpass ladder circuit

$R_1 = 1 \Omega$	$L_1 = 0.7654 \text{ H}$	$C_2 = 1.848 \text{ F}$	$L_3 = 1.848 \text{ H}$	$C_4 = 0.7654 \text{ F}$	$R_2 = 1 \Omega$
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Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III/II	Time	3 hrs.

**Subject: - Filter Design**

- ✓ 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 scaling in filter design? Why is it necessary? Derive the expression to determine the new value of circuit elements while applying magnitude and frequency scaling. [8]

2. Derive an expression to calculate the required order for given low pass specifications using inverse Chebyshev approximation. Using your expression calculate the order of inverse Chebyshev filter for following specifications: [12]

$$\alpha_{\max} = 0.5 \text{ dB}, \quad \alpha_{\min} = 15 \text{ dB}$$

$$\omega_p = 1000 \text{ rad/s}, \quad \omega_s = 2000 \text{ rad/s}$$

Also show pole, zero locations.

3. Which of the following functions are LC driving point impedance function and why? Explain. [8]

$$Z_1(s) = \frac{s^4 + 20s^2 + 64}{s^5 + 34s^3 + 225s} \text{ and } Z_2(s) = \frac{s^5 + 20s^3 + 64s}{s^4 + 10s^2 + 9}$$

Pick one of the valid LC impedance and synthesize it in foster parallel form.

4. What is the importance of frequency transformation in filter design? How bandstop filter can be obtained from suitable low pass prototype? Explain. [8]

5. Design an active filter to realize the bilinear transfer function with zero at 1kHz, pole at 12kHz and high frequency gain of 20dB. [8]

6. Draw the neat and clean diagram of Tow-Thomas lowpass biquad filter, and derive the transfer function. Design a low pass filter using Tow-Thomas biquad which has poles at  $-450 \pm 893.03j$  and dc gain of 1.5. Your final circuit should contain practically realizable elements. [12]

7. Define sensitivity, and explain the importance of sensitivity analysis in filter design. Perform sensitivity analysis of Tow Thomas lowpass biquad filter. [8]

8. What is Frequency Dependent Negative Resistor? How can it be used to avoid use of inductor in filter circuit? Explain with suitable example. [8]

9. What is switched capacitor filter? Design a switched capacitor filter to realize the transfer function: [8]

$$T(S) = \frac{(s + 200)(s + 800)}{(s + 400)^2}$$

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

**Subject: - Filter Design**

- ✓ 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. The magnitude squared function of Butterworth filter is given as:  $(5+3+2+4+6)$  [20]

$$|T_a(j\omega)|^2 = \frac{1}{1 + (\omega/\omega_0)^{2n}}$$

- Derive an expression to calculate the required order for given low pass filter specifications.
- Using this expression calculate the required order for following low pass specifications.  
 $\alpha_{\max} = 1 \text{ dB}, \quad \alpha_{\min} = 10 \text{ dB} \quad \omega_p = 1000 \text{ rad/s} \quad \omega_s = 2000 \text{ rad/s}$
- Calculate half power frequency.
- Plot pole-zero location and determine the transfer function.
- Realize the transfer function using Sallen-Key circuit.

2. Find an LC ladder to realize the following impedances simultaneously. [10]

$$Z_{11} = \frac{s^2 + 5}{s(s^2 + 10)}, \quad \text{and} \quad Z_{21} = \frac{Ks^2}{s(s^2 + 10)}$$

3. To obtain higher order active filters in filter design, instead of using cascaded biquads, why is it necessary to simulate LC ladder circuits? Explain leapfrog simulation of LC ladders with suitable example. [10]

4. Define passband, stopband and transition band with necessary diagram. A wide-band input signal of amplitude 100 mV is applied to the filter. In the stopband, the signal components at output of filter must be no larger than 50  $\mu\text{V}$ . Determine the required stopband attenuation  $\alpha$  of the filter in dB. [8]

5. What is positive real function? Discuss the properties of LC driving point impedance function with suitable example. [8]

6. Compare active filter with passive filter. Design an active filter using non-inverting op-amp configuration with following transfer function: [8]

$$T(s) = \frac{s+8}{s+2}$$

7. Draw the neat and clean diagram of multiple feedback (MFB) lowpass biquad circuit and derive the transfer function. Design a MFB biquad for the following transfer function: [8]

$$T(s) = \frac{1}{s^2 + 1.2s + 1}$$

8. Define sensitivity. What is its importance in filter design? Compute the sensitivity expression for cutoff frequency and quality factor of RLC lowpass filter. [8]

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

**Subject: - Filter Design**

- ✓ 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.

- Derive the relation to calculate the order,  $n$  of low-pass Butterworth approximation. Using this formula calculate the order for following low-pass specifications: [4+3+3+2]

$$\alpha_{\max} = \alpha_p = 1 \text{ dB}$$

$$\alpha_{\min} = \alpha_s = 12 \text{ dB}$$

$$\omega_p = 1000 \text{ rad/s}$$

$$\omega_s = 2000 \text{ rad/s}$$

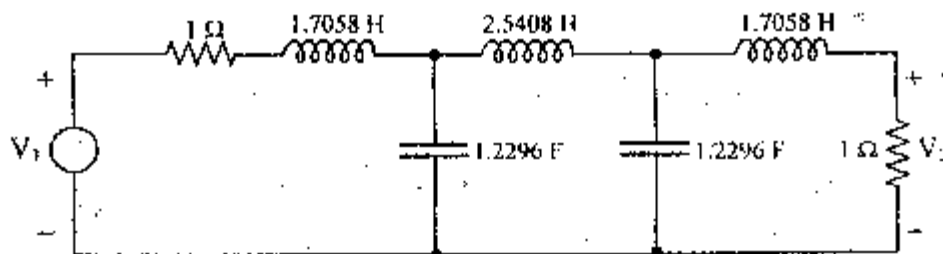
Also determine transfer function and plot pole locations.

- Draw the complete circuit of Tow Thomas biquad low-pass filter and derive its transfer function. Using this circuit realize the second order low pass filter with poles  $-2000 \pm j3464.102$  and dc gain of 2.5. In your final circuit capacitor should be  $0.01 \mu\text{F}$ . [6+6]
- Which of the following functions are LC driving point impedance function and why? [4+3+3]

$$Z_1(s) = \frac{s^5 + 20s^3 + 64s}{s^4 + 34s^2 + 225}, \quad Z_2(s) = \frac{s^4 + 9s^2 + 8}{s^3 + 4s}, \quad \text{and} \quad Z_3(s) = \frac{s^3 + 13s^2 + 44s + 32}{s^3 + 8s^2 + 12s}$$

Pick one of the valid LC impedance and synthesize it in foster parallel, as well as LC ladder form.

- What are the properties of lossless two-port networks? How zeroes of transmission can be realized in two port network? Show with suitable example. [3+5]
- The following circuit is a fifth order Chebyshev lowpass filter with a 0.5 dB ripple, normalized so that the 3-dB bandwidth is  $1.0 \text{ rad/s}$ . [8]



Realize this using FDNR such that the half power bandwidth is  $1432.5 \text{ Hz}$ . Your final circuit should contain practically realizable elements.

- What are the characteristics of ideal filter? Compare the characteristics of ideal filter with that of practical filter. [6]
- What do you mean by frequency transformation? Why it is necessary? Explain with example. [6]
- What are the properties of Bessel Thomson response? How can you design constant delay filter? [6]
- Why sensitivity analysis is important in filter design? Show how changes in each capacitors  $C_i$  affect the filter parameters  $\omega_0$  and  $Q$  in Tow Thomas biquad circuit. [6]
- What is switched capacitor filter, and where it is used? How inverting lossy integrators and non-inverting can be realized using switched capacitor? [6]

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

**Subject: - Filter Design**

- ✓ 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.

- Derive element scaling equations. Explain the importance of scaling in filter design. [6]
- Discuss the properties of positive real function with suitable examples. [6]
- Determine whether the following functions are RC driving point admittance functions or not, state with reason. [10]

$$Y(s) = \frac{(s+1)(s+4)}{s(s+2)} \text{ and } Y(s) = \frac{3(s+1)(s+4)}{(s+3)(s+6)}$$

Pick one of the valid RC admittance function and realize it in parallel Foster form, as well as RC ladder form.

- Synthesize the two port network whose parameters are defined as: [8]

$$Z_{11} = \frac{2s^2 + 1}{s(s^2 + 2)}, \text{ and } Z_{21} = K \frac{s^2 + 4}{s(s^2 + 2)}$$

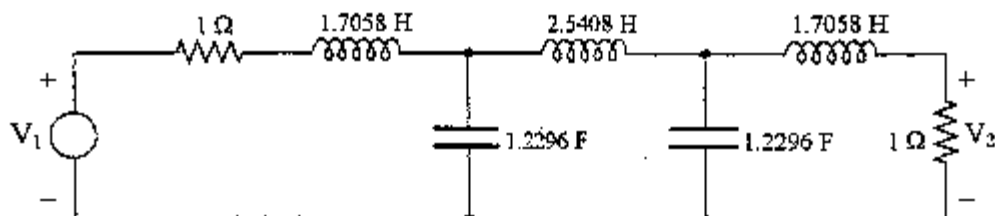
- Compare Butterworth approximation with inverse Chebyshev approximation. [6]
- Derive the expression to calculate the order (n) of Butterworth approximation. And using this expression, calculate the order of Butterworth filter for following low pass specifications: [12]

$$\alpha_{\max} = \alpha_p = 1 \text{ dB} \quad \alpha_{\min} = \alpha_s = 20 \text{ dB}$$

$$\omega_p = 1000 \text{ rad/s} \quad \omega_s = 2000 \text{ rad/s}$$

Show the pole locations, and determine the transfer function.

- Derive the transfer function of Tow Thomas biquad circuit (lowpass). Then design a second order lowpass filter using Tow Thomas biquad with poles  $-4000 \pm j 9165.1514$  and a dc gain of 2. In your final circuit capacitor value should be within  $0.1 \mu\text{F}$  to  $0.001 \mu\text{F}$ . [10]
- Define sensitivity. Perform the sensitivity analysis of Tow Thomas biquad lowpass filter. [8]
- What is switched capacitor filter? How can you realize summing integrator and lossy integrator using switched capacitor? Explain with necessary diagrams. [6]
- The following circuit is the lowpass filter having half power bandwidth of  $1.0 \text{ rad/s}$ . [8]



Realize above filter using FDNR, such that the half power bandwidth is  $5 \text{ kHz}$ . Your final circuit should contain practically realizable values.

Exam.	Back		
Level	B.E.	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Filter Design**

- ✓ 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) Define half-power point, bandwidth, roll-off, pass-band and stop-band with necessary diagrams. [5]

b) What are the properties of lossless driving point impedance function? Explain with examples. [6]

2. a) Identify the following driving point impedance. Then synthesize using foster series and foster parallel method. [8]

$$Z(s) = \frac{s^5 + 6s^3 + 8s}{s^4 + 4s + 3}$$

b) Express impedance parameters in terms of admittance parameters. [5]

3. a) Distinguish between Butterworth approximation and Elliptic approximation. [6]

b) Derive the expression to estimate the order (n) of Inverse Chebyshev approximation. Use this formula to estimate the order of Inverse Chebyshev for following specifications: [12]

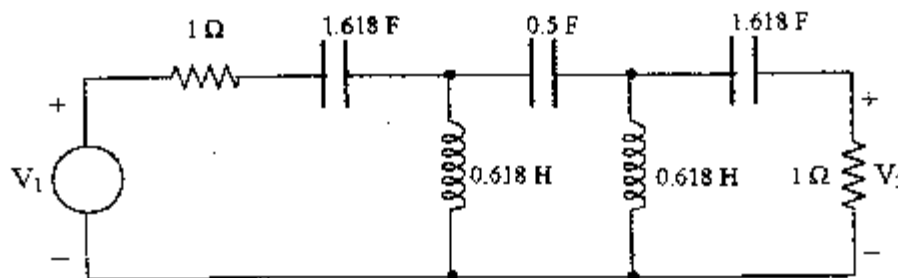
$$\begin{aligned} \omega_p &= 1000 \text{ rad/s} & \omega_s &= 1500 \text{ rad/s} \\ \alpha_{\text{max}} &= \alpha_p = 0.5 \text{ dB} & \alpha_{\text{min}} &= \alpha_s = 22 \text{ dB} \end{aligned}$$

Determine the pole locations and transfer function.

4. a) Design a second order lowpass filter using Tow Thomas biquad circuit with poles  $-2000 \pm j 4582.58$  and a dc gain of 2. In your final design capacitor value should be  $0.01 \mu\text{F}$ . [8]

b) What is leapfrog simulation of passive filter? Explain with a suitable example. [9]

5. a) Realize the following passive filter by active simulation of grounded inductors. [8]



Use frequency scaling factor  $k_f = 2000$  and also perform the magnitude scaling to get practically realizable element values in your final circuit.

b) What is switched capacitor filter? What is significance of MOS switching frequency in switched capacitor filter? Explain with a suitable example. [8]

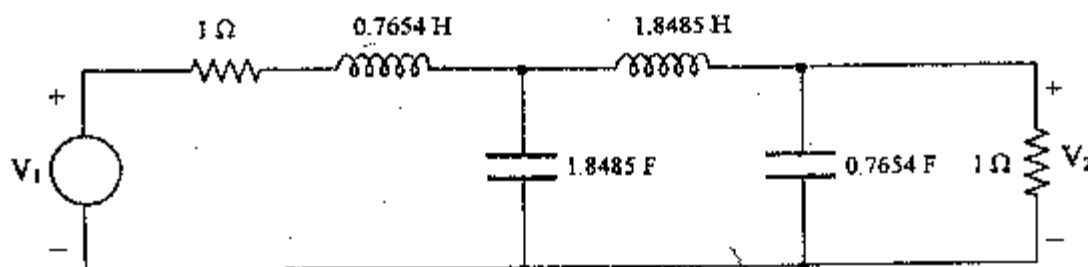
c) Define single parameter sensitivity. Why sensitivity analysis is necessary? [5]

Exam.	Regular / Back		
Level	B.E.	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Filter Design**

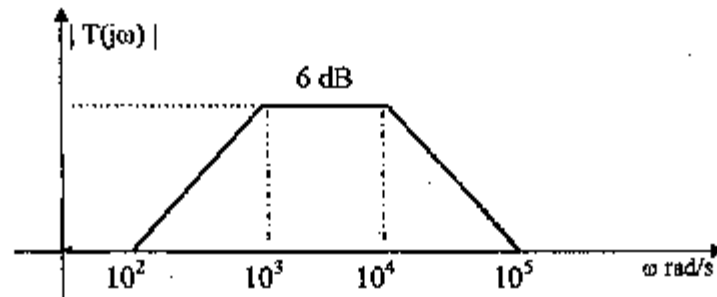
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) Distinguish between magnitude scaling and frequency scaling? What is the significance of scaling in filter design? [6]  
 b) Show the difference between LC and RC driving point impedance function with examples? [6]
2. a) Identify the following driving point impedance. Then synthesize using Cauer I and Cauer II method,  $Z(s) = \frac{s^4 + 40s^2 + 144}{s^3 + 16s}$  [8]  
 b) Derive the expressions to calculate admittance parameters in terms of impedance parameters. [5]
3. a) How can you design a constant delay filter? Explain. [6]  
 b) Derive the expression to calculate the order (n) of Chebyshev approximation. And using this formula, calculate the order of Chebyshev filter for following lowpass specifications: [12]  
 $\omega_p = 1 \text{ rad/s}$                        $\omega_s = 1.8 \text{ rad/s}$   
 $\alpha_{\max} = \alpha_p = 0.5 \text{ dB}$                $\alpha_{\min} = \alpha_s = 20 \text{ dB}$   
 Show pole locations and determine the transfer function.
4. a) Design a third order lowpass Butterworth (Refer table 1) filter using Sallen-Key biquad with ( $\omega_0 = 3000 \text{ rad/s}$ . Perform gain compensation if necessary. Choose the capacitor values between  $0.1 \mu\text{F}$  to  $0.001 \mu\text{F}$ . [10]  
 b) Define generalized impedance converter. Explain the active simulation of grounded inductor in filter design. [8]
5. a) Realize the following lowpass filter using FDNR (frequency dependent negative resistor). [9]



Given passive filter is designed at normalized frequency. So perform frequency scaling to make  $\omega_0 = 1000$  and finally your circuit should contain practically realizable values.

- b) Design a switched capacitor filter to realize the magnitude response given below. [10]



Use suitable MOS switching frequency.

**Table 1:**  
Pole Locations for Butterworth Responses

$n=2$	$n=3$	$n=4$	$n=5$	$n=6$
-0.7071068	-0.50	-0.3826834	-0.809017	-0.258819
$\pm j 0.7071068$	$\pm j 0.86603$	$\pm j 0.9238795$	$\pm j 0.5877852$	$\pm j 0.9659258$
	-1.0	-0.9238795	-0.309017	-0.7071068
		$\pm j 0.3826834$	$\pm j 0.9510565$	$\pm j 0.7071068$
			-1.0	-0.9659258
				$\pm j 0.2588190$

\*\*\*

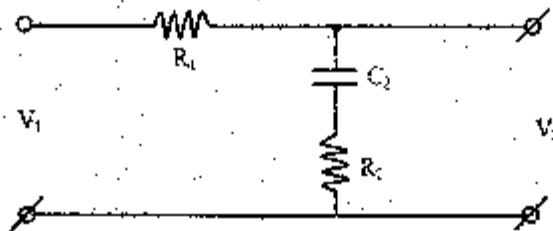
*Handwritten note:*  
The filter is a Butterworth filter.  
The magnitude response is given by:  
 $|T(j\omega)| = \frac{1}{\sqrt{1 + \omega^{2n}}}$

Exam.	Regular / Back		
Level	B.E.	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs

**Subject: - Filter Design**

- ✓ 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 tables are attached herewith.
- ✓ Assume suitable data if necessary.

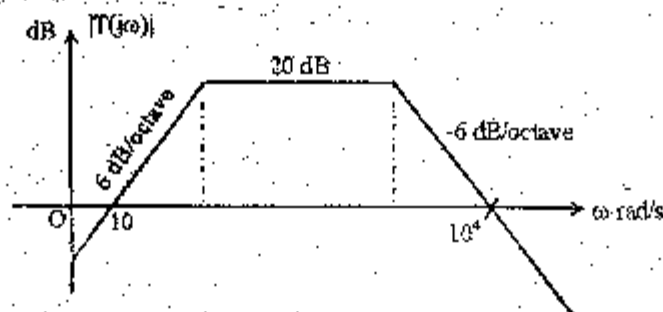
1. a) Distinguish among the terms: cut off frequency ( $\omega_c$ ), half-powerpoint ( $\omega_{hp}$ ), centre frequency ( $\omega_o$ ) clearly with neat diagrams. [1+1+1]
- b) For the given circuit below, find transfer function  $T(S)$ . Also plot the magnitude and phase response indicating the location of poles and zeros. [2+2+2+1]



2. a) What are the properties of LC circuit? Show that  $Z(S)$  is the ratio of the even by odd function or odd by even function in LC circuit. [3+3]
- b) Find the expression for Z-parameters in terms of Y-parameters? What do you mean by residue condition? Explain. [5+3]
3. a) Realize the following function using Cauer-I and Cauer-II method. [4+4]

$$F(S) = \frac{4S^3 + 16S + 12}{S^3 + 8S + 12}$$

- b) Explain Chebyshev approximation for low pass filter and derive expression for the order of filter ( $n$ ). [10]
4. a) Define single parameter and multiparameter sensitivities? What is its significance in filter design? Also, explain, what do you mean by gain allocation? [2+2+2+2]
- b) Design a 4<sup>th</sup> order lowpass filter, implemented by using active leapfrog method with the half power point being 20,000 rad/sec. [10]
5. a) For the asymptotic bode plot shown in figure below, find  $T(S)$  and realize it by using switched capacitor MOS filter. Choose reasonable clock frequency of your own. [10]



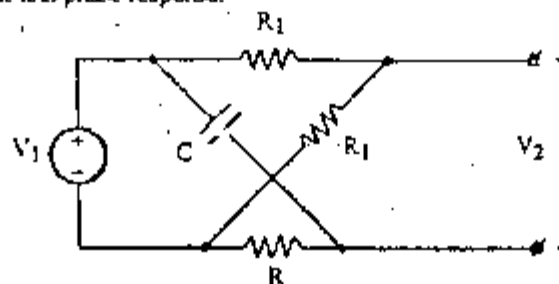
- b) What is Antoniou GIC? Find expression for  $Z_{11}$  and explain how you can simulate floating inductor using GIC. [1+5+4]

Level	B.E.	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / E	Time	3 hrs.

**Subject: - Filter Design**

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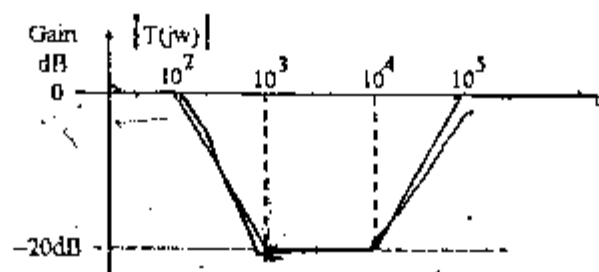
1. a) What do you mean by insertion loss? Compare active and passive filter. What are the basis of their selection? Which do you prefer? Give reasons. [1+4+1]
- b) For the circuit shown in figure below, determine the transfer function, show pole-zero locations and plot magnitude and phase response. [2+2+4]



2. a) Define PRF. What are the properties of PRF? What is its significance? Discuss. [1+3+1]
- b) Realize the given function  $Z(S)$  using Cauer-I and Cauer-II method, where [4+4]

$$Z(S) = \frac{2S^5 + 12S^3 + 16S}{S^4 + 4S^2 + 3}$$

3. a) Define loss-less two port networks. Explain its properties. What do you mean by private and transmission poles? [1+2+2]
- b) A voltage of  $200 \angle 0^\circ$  V is applied at terminal pair - 1 with terminal pair - 2 open, results in current  $I_1 = 20 \angle 0^\circ$  A and  $V_2 = 50 \angle 0^\circ$ . The same voltage is applied to terminal pair - 2, with terminal pair - 1 open, results in  $I_2 = 40 \angle 0^\circ$  and  $V_1 = 80 \angle 0^\circ$ . (i) Find impedance matrix, (ii) the loop equation for this network and (iii) what will be the voltage across a  $20\Omega$  resistor connected across terminal pair - 2 if a  $100 \angle 0^\circ$  volt source is connected across terminal pair - 1 [4+2+2]
4. a) Discuss Chebyshev approximation in filter design. Make comparison between Butterworth, Chebyshev, Inverse Chebyshev and elliptic filter with neat diagrams. [3+3]
- b) Design second order Butterworth filter using Sallen key biquad and perform gain allocation if needed. Use  $\omega_0 = 2000\pi$  rad/s and  $C = 0.1\mu\text{F}$  to calculate other component values [8]
5. a) Why filter element sensitivity is important in filter design. Discuss single-parameter and multi-parameter sensitivities in detail. [2+4]
- b) Design switched capacitor MOS filter which satisfies the given magnitudes response in Bode plot. You can choose reasonable clock frequency of your own. [8]



6. Design a Butterworth fourth order lowpass filter with half power frequency of 10KHz. The filter must be implement in leapfrog active filter. [12]

Exam.	Regular / Back		
Level	B.E.	Full Marks	80
Programme	BEN	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Filter Design**

- ✓ 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 missing data if necessary.

1. a) Discuss the Butterworth approximation in filter design. Differentiate between Butterworth and Chebyshev approximations. [6+2]
- b) The following specifications are given for a Butterworth low-pass filter.  
 $\alpha_p = -1 \text{ dB}$ ,  $\alpha_s = 25 \text{ dB}$  and  $\frac{\omega_s}{\omega_p} = 1.5$ .  
 Determine:  
 i) the filter order which is required to meet the above specifications. [4]  
 ii) the half-power frequency. [4]
2. a) Discuss the need and importance of filter design in the field of electronics engineering. [5]
- b) Differentiate between an ideal brick-wall response and practical responses. [5]
- c) Define the following terms: half-power point, band width, gain and attenuation. [6]
3. a) Draw a neat circuit diagram of a Tow-Thomas Biquad circuit. Explain the function of each of the three important blocks in the circuit. Derive the transfer function of each of the blocks as well as the overall transfer function. [2+3+5]
- b) Discuss Design II method in Sallen-key biquad design. [6]
4. a) What is P-R function? Why a function need to be PR function? Explain with a suitable example. [3+4]
- b) Given  $F(s)$  is the driving point admittance function of an LC network. Synthesize the function [6]  

$$F(s) = \frac{4(s+1)(s+3)}{(s+2)(s+6)}$$
- c) Explain properties of two port network. [3]
5. a) Explain why Leapfrog simulation of passive filter is needed, use a suitable example to support your explanation. [5]
- b) What is Generalized Impedance Converter? Discuss the active simulation of grounded inductor in filter design. [6]
- c) Discuss the operation of a switched capacitor filter. Explain its application. [5]

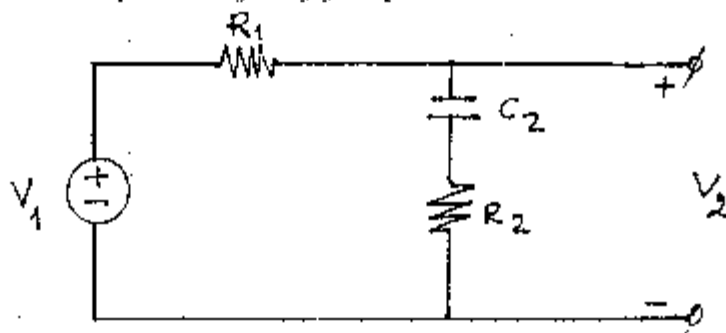
16 / S-5 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2057 Bhadra

Exam.	Regular/Back		
Level	B.E.	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Filter Design**

- ✓ 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**.

1. a) Define half-power point and attenuation. Explain how can you define filter types from attenuation curve? [3+3]
- b) Plot the magnitude and phase responses for given R-C filter circuit. Show the location of poles and zeros in s-plane and justify your plots. [8]



2. a) Define P-R function and explain its importance in realization of a network. [6]
- b) The driving point impedance of an one port L-C network is  $Z(s)$ . Synthesize the driving point impedance in First Cauer form. [6]

$$Z(s) = \frac{s(s^2 + 4)}{2(s^2 + 1)(s^2 + 9)}$$

- c) Discuss the properties of lossless two port network [4]
3. a) Discuss Chebyshev approximation in filter design. Differentiate between Chebyshev and Inverse-Chebyshev approximations. [3+3]
- b) Discuss Bessel-Thomson method of constant delay filter design. [6]
4. a) What is Gain Enhancement? Explain why it is necessary in Sallen-Key active filter design? [2+4]
- b) What is RC-CR transformation? Show that a low pass Sallen-Key active filter will be high-pass filter if RC-CR transformation is applied in low-pass Sallen-Key. [3+4]
- c) Design a MFB biquad to meet following specification:  $G = 4$ ,  $b_1 = 1.3$ , and  $b_0 = 1$  [6]

- a) What is Frequency Dependent Negative Resistance? Explain how FDNR can replace the inductor in filter circuit? [2+4]

Explain active simulation of passive filter using Leapfrog method. [6]

What is a switched capacitor filter and what are the limitations of this kind? Explain in detail with a suitable example. [2+4]

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JRDHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
Shrawan - 2055

Exam.	Regular	34/5/20
Level	B.E.	Full Marks 80
Programme	BEX	Pass Marks 32
Year / Part	III/II	Time 3 hrs.

**Subject:- Filter Design**

- \* Candidates are required to give their answers in their own words as far as practicable.
- \* Attempt ALL questions.
- \* The figures in the right margin indicate full marks.
- \* Necessary figures and tables are attached herewith.

- 1.(a) Define half-power point, bandwidth, skirt, and roll-off. (8)
- (b) Plot the magnitude and phase responses for given R-C filter circuit. Justify the plots with the help of locations of poles and zeros in s-plane. (8)
- (See Fig.-1)

- 2.(a) Discuss the basic techniques of synthesis of a given P-R function in detail. (6)
- (b) Given  $F(s)$  is the driving point admittance function of a R-L network. Synthesize the function. (5)

$$F(s) = \frac{4(s+1)(s+3)}{(s+2)(s+6)}$$

- (c) Find Y-parameters of given network in terms of Z-parameters. (5)
- 3.(a) Discuss Inverse-Chebyshev approximation in filter design. Differentiate between Chebyshev and Inverse-Chebyshev approximations. (6)
- (b) The following specification are given for a Chebyshev low-pass filter : (10)

$$\frac{\omega_s}{\omega_p} = 1.5$$

$$\alpha_{\max} = \alpha_p = 1dB$$

$$\alpha_{\min} = \alpha_s = 22dB$$

Determine :

- (i) the filter order which is required to meet the above specification
  - (ii) the half-power frequency
  - (iii) the network function.
- 4.(a) Why filter element sensitivities is important in filter design ? Discuss single-parameter and multi-parameter sensitivities in detail. (8)
- (b) What is Generalized Impedance Converter ? Discuss the active simulation of grounded inductor in filter design. (8)
- 5.(a) What is Leapfrog simulation of a passive filter and why it is needed ? Explain in detail with a suitable example. (8)
- (b) Design a switched capacitor filter which satisfies the given magnitude response in Bode-plot. Choose the suitable MOS switching frequency in your design. (8)

(See Fig.-2)