6E7151

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6E7151

B.Tech. VI-Sem. (Main/Back) Exam., May–2025

ELECTRONICS & COMMUNICATION ENGINEERING

6EC3-01/ Power Electronics

EC, EI

Time : 3 Hours **Maximum Marks : 70**

Instructions to Candidates :

Attempt all ten questions from Part-A, five questions out of seven questions from Part-B and three questions out of five questions from Part-C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in Form No. 205)

1..... 2.....

PART-A [10x2=20]

(Answer should be given up to 25 words only)

All questions are compulsory

Note : All questions are **compulsory** :

Q.1. What is a Diode ? Give the difference between Power and Signal Diode.

Q.2. Why are IGBTs becoming popular in their applications to Controlled Converters ? Enumerate some applications of IGBTs.

Q.3. What is Natural or Line commutation in Phase controlled rectifiers ?

Q.4. What are the advantages of three phase converters over Single phase converters ?

Q.5. What are the basic differences between Voltage source and Current source Inverter ?

Q.6. Explain the main functional difference between Inverter, Converter and Chopper.

Q.7. What is DC Chopper ? Enumerate the various types of chopper configuration with appropriate diagram.

Q.8. Enumerate the different methods for speed control of Three Phase Induction Motor.

Q.9. In a three phase half-wave diode rectifier, if per phase Input voltage is 200 V. Then calculate the average output voltage.

Q.10. In a single phase full converter, if output voltage has peak and average values of 325 V and 133 V respectively. Then calculate the firing angle.

PART-B [5x4=20]

(Analytical/Problem solving questions)

Attempt any Five questions

Q.1. Explain the basic structure, construction and characteristics of Power MOSFET.[4]

Q.2. Explain the basic concept, working principal of Single phase half-wave Bridge converter with RL load. [4]

Q.3. Explain the principle of operation of step down Chopper with the help of circuit diagram and waveforms. [4]

Q.4. What is SMPS ? Describe SMPS using Half-bridge and Full bridge configuration.[4]

Q.5. Explain the speed control of DC motors using Choppers. [4]

Q.6. A 230 V, 50 Hz one pulse SCR controlled converter is triggered at a firing angle of 15° and the load current extinguishes at an angle of 18°, find the : [2x2=4]

(a) Average output voltage

(b) Averge load current

Q.7. Explain the operation of three phase voltage source Inverter in 120° mode of operation with suitable waveforms.

PART-C [3x10=30]

(Descriptive/Analytical/Problem Solving/Design question)

Attempt any three questions

Q.1. (a) Explain the construction, and working of IGBT. [5]

(b) Compare the V-I characteristics of Diac and Triac. [5]

Q.2. What is Current Source Inverter ? Explain working of Single phase current source Inverter with circuit diagram and output waveforms. [10]

Q.3. Explain the frequency controlled method for speed control of three phase Induction Motor. Also draw the speed torque characteristics of three phase Induction Motor with frequency control with constant supply voltage. [10]

Q.4. (a) Explain the principle of Uninterrupted Power Supply. [5]

(b) Briefly describe the Boost converter. [5]

Q.5. (a) Explain the Chopper Control Strategies. [5]

(b) A step up Chopper has Input voltage of 220 V and Output of 660 V. If the non-conducting time of thyristor chopper is 100 μs, compute the pulse width of output voltage. [5]

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6E7152

B.Tech. VI-Sem. (Main/Back) Exam. May - 2025

Electronics and Communication Engg.

6EC4-02 / Computer Network

Time : 3 Hours **Maximum Marks : 70**

Instructions to Candidates :

Attempt all ten questions from Part-A, five questions out of seven questions from Part-B and three questions out of five questions from Part-C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in Form No. 205)

1. ..... 2. .....

PART-A **[10x2=20]**

(Answer should be given up to 25 words only)
All questions are compulsory

Q.1 What is Little Formula?

Q.2 Define Hyper Text Transfer Protocol (HTTP).

Q.3 What is Domain Name System?

Q.4 Differentiate between TCP and UDP.

Q.5 What is Remote Procedure Call?

Q.6 What is addressing in Computer Network?

Q.7 Explain the concept of LAN, WAN, MAN.

Q.8 What is 802.11 is Computer N/W?

Q.9 What is the use of Virtual Circuit?

Q.10 What is Peer-to-peer Computer Networking?

PART-B [5x4=20]

(Analytical/Problem solving questions)

Attempt any five questions

Q.1 Explain Application layer in detail. What is layering in Computer Network?

Q.2 Describe switching techniques used in Computer Network.

Q.3 What are the resource allocation issues arises in Computer Network?

Q.4 Explain the working principle of router in Computer Network.

Q.5 Describe the concept of SDN. What are the three components of SDN?

Q.6 What do you mean by Open Flow? Explain the structure of open flow.

Q.7 What is Socket Programming? Explain the types of socket used in Computer Network.

PART-C [3x10=30]

(Descriptive/Analytical/Problem Solving/Design questions)

Attempt any three questions

Q.1 (a) Explain the concept of Queuing Theory used in Computer Network. [4]

(b) Write a short note on mathematical model : [6]

(i) M/M/1

(ii) M/M/m

(iii) M/M/m/m

Q.2 (a) What is the principle of packet-switching? What are the factors responsible for packet loss? [4]

(b) Write short notes on the following : [6]

(i) Buffering

(ii) Multicasting

(iii) Statistical Multiplexing

Q.3 Explain the concept of TCP Congestion control. What are the mechanism used to avoid the congestion? How is the quality of service can be improved in Computer Network? [10]

Q.4 (a) Explain the concept of Routing Algorithm. Describe the working mechanism of Dijkstra's Algorithm. [6]

(b) Write short notes on the following : [4]

(i) Broadcast routing

(ii) Multicast routing

Q.5 (a) Explain the concept of ALOHA and its type. [4]

(b) Write short notes on the following : [6]

(i) Ethernet

(ii) Hub

(iii) Switches

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Total No. of Questions : 22 Total No. of Pages : 04

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6E7153

B. Tech. VI-Sem. (Main/Back) Exam., May-2025
Electronics and Communication Engg.

6EC 4-03 Fiber Optics Communications

Time : 3 Hours Maximum Marks : 70

Note : Attempt all 10 questions from Part-A, 05 questions out of 07 questions from Part-B and 03 questions out of 05 questions from Part-C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in Form No. 205)

1. ..... 2. .....

PART-A

Q.1. Explain the working principle of optical fiber communication.

Q.2. Describe the Evancent field in OFC.

Q.3. Which profiles is preferred in the graded index profile.

Q.4. Describe the applications of splices in OFC.

Q.5 Differentiate between single and multimode fibers.

Q.6. What is the need of optical amplifier?

Q.7. Which type of semiconductor material is use for manufacturing of FOC components?

Q.8. Explain different types of misalignment occur in optical fiber jointing.

Q.9. List the different types of the noise encounter in optical detectors.

Q.10. Draw the power characteristics of LED.

PART-B

Q.1. Draw and explain the block diagram of optical fiber communication system with labelled diagram.

Q.2. A multimode step index fiber with a core diameter of 80 μm and a relative index difference of 1.5% is operating at a wavelength of 0.85 μm. If the core refractive index is 1.48, estimate;

(i) The normalized frequency for fiber.

(ii) The number of guided modes.

Q.3. Describe the common LED structure for optical fiber communication; also give their merits and demerits.

Q.4. Analyze the different types of splices and connectors use in optical fiber communication with neat diagram.

Q.5. Why optical amplifiers required in optical fiber communication? Explain Fiber Raman amplifier with neat diagram.

Q.6. Distinguish between WDM and DWDM. What is the base frequency and channel spacing specified by ITU for DWDM?

Q.7. What is the need of rise time budget in optical communication? Explain the process of rise time budgeting done in optical networks.

PART-C

Q.1. Describe the following characteristics of injection LASER;

(i) Frequency chirp

(ii) Noise

(iii) Reliability

(iv) Threshold current temperature dependence

Q.2. Photons of wavelength 0.90 μm are incident on p-n photodiode at a rate of 5×10^{10} s^{-1} and, on an average, the electrons are collected at the terminals of the diode at the rate of $2 \times 10^{10} s^{-1}$. Calculate ;

(i) The quantum efficiency

(ii) The responsivity of the photo diode at this wavelength.

Q.3. The radiative and non-radiative recombination lifetimes of the minority carriers in the active region of a double hetrojunctions LED are 60 ns and 100 ns respectively. Determine the total carrier recombination lifetime and the power internally generated within the device when the peak emission wavelength is 0.87 μm at a drive current of 40 mA.

Q.4. What is the need of Optical Time Domain Reflectometry (OTDR) in optical fiber communication? Explain the process of fault location identification with neat graph and diagram.

Q.5. Why should we study non-linear fiber optics? Explain the Kerr non-linearity and other non-linearity in details for optical communication.

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6E7154

B.Tech. VI-Sem. (Main/Back) Exam., May–2025

Electronics and Communication Engg.

6EC 4-04 Antennas and Propagation

Time : 3 Hours **Maximum Marks : 70**

Instructions to Candidates :

Attempt all 10 questions from Part-A, 05 questions out of 07 questions from Part-B and 03 questions out of 05 questions from Part-C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in Form No. 205)

1. ..... 2. .....

PART-A *[10×2=20]*

(Answer should be given up to 25 words only.)

All questions are compulsory.

Q.1. Define the directivity and gain of antenna.

Q.2. What are the advantages of array antenna?

Q.3. What are the advantages of rhombic antenna?

Q.4. Define and draw the structure of the loop antenna.

Q.5. Draw the feed mechanisms of reflector antennas.

Q.6. Draw the structure of log-periodic Yagi-Uda array antenna.

Q.7. What are the advantages and disadvantages of a patch antenna?

Q.8. What is radio-wave propagation?

Q.9. Explain the term Virtual height and Skip distance.

Q.10. What are various types of Horns antenna?

PART-B [5×4=20]

(Analytical / Problem solving questions.)

Attempt any five questions.

Q.1. The frequency of an antenna is 5 GHz. Calculate the gain of the antenna having circular aperture of diameter 3 meters.

Q.2. Derive the expression for radiation power and radiation resistance of quarter-wave monopole antenna.

Q.3. Obtain the pattern of a two-element array fed 180° out of phase (end-fire) and spaced at d= λ /2.

Q.4. Sketch a 3-element Yagi-Uda antenna. Describe the importance of length of reflector and its separation from driven element with regard of performance of Yagi-Uda antenna.

Q.5. Describe feed techniques of patch antennas. How do they differ from each other?

Q.6. Describe the tropospher and scatter wave propagation.

Q.7. Describe the concept and benefits of smart antenna.

PART-C [3×10=30]

(Descriptive / Analytical / Problem solving / Des ign questions.)

Attempt any three questions.

Q.1. In a 20 km microwave communication link, two identical antennas are operating at frequency 20 GHz with a power gain of 40 dB. The transmitted power is 1.5W. Find the received power if there are no loss.

Q.2. Derive and draw the radiation pattern of 4-isotropic sources of equal amplitudes and phases in broadside and end-fire arrays.

Q.3. What are the characteristic features of circular and square loop antennas? Write the expressions for their far-fields.

Q.4. Design a rectangular patch antenna on substrate having Er =4.34 and h=0.18cm. The antenna is fed by a transmission line of impedance 50 Ω and to be operated at f=2.5 GHz. Also draw the MIC structure.

Q.5. Write notes on the following :

(a) Adaptive beamforming

(b) Frequency independent antenna

(c) Dipole for mobile communication

(d) Hygen's principle

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Total No. of Questions : 22 Total No. of Pages : 03

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6E7156

B.Tech. VI-Sem. (Main/Back) Exam., May-2025

ELECTRONICS AND COMMUNICATION ENGG.

6EC 5-11 Introduction to MEMS (El.-II)

Time : 3 Hours **Maximum Marks : 70**

Instructions to Candidates :

Attempt all ten questions from Part-A, five questions out of seven questions from Part-B and three questions out of five questions from Part-C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in Form No. 205)

1. ..... 2. .....

PART-A **[10x2=20]**

(Answer should be given up to 25 words only)

All questions are compulsory

Q.1. Define Strain.

Q.2. Give the name of basic MEMS materials.

Q.3. What is Hooke's Law?

Q.4. What is Electrostatic Sensor?

Q.5. Define wet etching.

Q.6. Which PVD techniques mostly used for metal contacts fabrication and why?

Q.7. Draw the flow diagram of deposition process.

Q.8. Which etchants are commonly used to each Silicon?

Q.9. How do you calculate strain from bending stress?

Q.10. What is Epitaxy?

PART-B **[5x4=20]**

(Analytical/Problem solving questions)

Attempt any five questions

Q.1. Write a brief note on finite element method for analysis.

Q.2. What is the importance of miller Indices during etching? Explain briefly.

Q.3. Differentiate Isotropic Etching and Anisotropic Etching.

Q.4. What is wafer bonding? Explain briefly.

Q.5. Explain the mechanical Actuators with suitable diagrams.

Q.6. Explain Deep Reactive-Ion Etching (DRIE).

Q.7. Explain X-Ray Lithography processes in detail.

PART-C [3x10=30]

(Descriptive/Analytical/Problem Solving/Design question)

Attempt any three questions

Q.1. What is the advantage of LIGA process over other micro-machining technique? Explain with block diagram the steps in LIGA process.

Q.2. Derive the displacement and stress/strain relation (at low fields) for piezoelectric, also explain about the parameter of Piezoelectric.

(a) Piezoelectric Strain Constant (d)

(b) Piezoelectric Strain Constant (g)

(c) Electromechanical Coupling Factor (k)

(d) Energy Transmission Coefficient (λ)

Q.3. Explain the following :

(a) Wafer

(b) Substrate and Active Substrate.

Q.4. Explain the process of Bulk micromachining of Silicon.

Q.5. Write short notes on **any two** of the following :

(a) Applications of MEMS

(b) Futures of MEMS

(c) Fabrication Technology of MEMS

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6E7190

B.Tech. VI-Sem. (Main/Back) Exam. - 2025

Electronics and Communication Engg.

6EC 4-05 5G Communication

Time : 3 Hours **Maximum Marks : 70**

Instructions to Candidates :

Attempt all ten questions from Part-A, five questions out of seven questions from Part-B and three questions out of five questions from Part-C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

Use of following supporting material is permitted during examination.

(Mentioned in Form No. 205)

1. ..... 2. .....

PART-A **[10×2=20]**

(Answer should be given up to 25 words only)

All questions are compulsory

Q. 1. Explain V2V and V2X.

Q. 2. What do you mean by base-station in communication?

Q. 3. Describe beam forming.

Q. 4. Briefly explain 4G LTE.

Q. 5. Give in detail objectives of 5G.

Q. 6. Define the roles of SDN and NFV in network Slicing.

Q. 7. Explain OFDM.

Q. 8. Give technical challenges in 5G spectrum.

Q. 9. Describe MIMO.

Q. 10. What do you mean by M2M type communication?

PART-B [5×4=20]

(Analytical/Problem-solving Questions)

Attempt any five questions

Q. 1. Using suitable diagram, explain D2D handover in 5G System.

Q. 2. With the help of suitable architecture, explain work of 5G network architecture.

Q. 3. Give the difference between OFDM and OFDMA.

Q. 4. Briefly explain the VC architecture.

Q. 5. With respect to communication, explain : [2+3=5]

(a) Moving network

(b) Device to Device link.

Q. 6. Explain various research challenges for D2D communication in 5G.

Q. 7. Compare 3G, 4G, and 5G communication techniques.

PART-C [3×10=30]

(Descriptive/Analytical/Problem-Solving/Design Question)

Attempt any three questions

Q. 1. With the help of diagram explain RAN architecture.

Q. 2. Explain working of NOMA.

Q. 3. Write short notes on the following : [5+5=10]

(a) Multi-hop and Multi-operator D2D communication

(b) Smart antenna for 5G

Q. 4. Explain spectrum access modes and propagation scenarios for 5G.

Q. 5. Explain briefly : [5+5=10]

(a) Beam-forming for communication

(b) Mobility management in MIMO

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6E1591

B.Tech. VI-Sem. (Back) Exam. - 2025

Electronics and Comm. Engg.

6EC3-01 / Power Electronics

EC,EI

Time : 2 Hours Maximum Marks : 80

Instructions to Candidates :

Attempt all five questions from Part-A, four questions out of six questions from Part-B and two questions out of three questions from Part-C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in Form No. 205)

1. ..... 2. .....

PART-A **[5x2=10]**

(Answer should be given up to 25 words only)

All questions are compulsory

Q.1. What are the main features of Power MOSFET? [2]

Q.2. What is the difference between single phase-half bridge and full bridge converter? [2]

Q.3. What is SMPS? What is its utility? [2]

Q.4. Name the methods of speed control of 3-phase induction motor. [2]

Q.5. A diode has a reverse recovery time of 2.5 msec. if dv/dt is 35 A/ms, find : [2]

(a) Storage Charge

(b) Peak Reverse Current

PART-B [4x10=40]

(Analytical/Problem solving questions)

Attempt any four questions

Q.1. (a) For the single phase semiconverters having resistive load of 'R' determine average output voltage and RMS output voltage. [5]

(b) Differentiate between enhancement and depletion type of MOSFET. [5]

Q.2. (a) Differentiate between step-up and step-down chopper. [5]

(b) Explain the latch-up in IGBT. How can it avoid? [5]

Q.3. A single phase half wave converter is operated from a 120 volt, 50Hz supply and the load resistance R=10 Ω . If the average voltage is 25% of the maximum possible average output voltage. Calculate: [5+5]

(i) Delay angle α

(ii) The rms output current

4. (a) Explain speed control of Dc motor using chopper. [5]

(b) Write advantages and disadvantages of Induction heating. [5]

Q.5. (a) Briefly explain the principle of reversible chopper. [5]

(b) Compare online with offline UPS system. [5]

Q.6. (a) Compare voltage source inverter with current source inverters. [5]

(b) Describe the different modes of operation of SCR with helps of its static V-I characteristics. [5]

PART-C **[2x15=30]**

(Descriptive/Analytical/Problem Solving/Design questions)

Attempt any two questions

Q.1. Write short notes on any three of the following : [5+5+5=15]

(a) Variable reluctance stepper motor

(b) Buck and Boost Converters

(c) Differentiate Transistors with Thyristors

(d) High frequency electronic Ballast

(e) Inverter and its few applications

Q.2. (a) A DC chopper circuit is connected to a 150 volt dc source. Supplies and Inductive load having 20 mH in series with a resistance of 3Ω. A free wheeling diode placed across the load, the load current varies between the limits of 15A and 30. A Determine the time ratio of chopper. [8]

(b) Briefly explain the merits and demerits of GTO as compare to conventional thyristors. [7]

Q.3. (a) Explain the two transistor analogy of thyristors and derive the expression for anode current (ia) using the analogy? [8]

(b) Differentiate Dirac with Triac and also explain the V-I characteristics of Diac. [7]

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Total No. of Questions : 22 Total No. of Pages : 04

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6E1592

B.Tech. VI-Sem. (Back) Exam. - 2025

ELECTRONICS AND COMM. ENGG.

6EC4-02 / Computer Network

Time : 3 Hours Maximum Marks : 120

Instructions to Candidates :

Attempt all ten questions from Part-A, five questions out of seven questions from Part-B and four questions out of five questions from Part-C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in Form No. 205)

1. .....

2. .....

PART-A

[10x2=20]

(Answer should be given up to 25 words only)
All questions are compulsory

Q.1. What are the key components of a Queuing System?

Q.2. Define little's law and its significance in Queuing theory.

Q.3. What is the difference between a socket and a port?

Q.4. What is fragmentation in IP Layer?

Q.5. Explain the difference between Error detection and error correction in link layer.

Q.6. State the difference between static and dynamic routing.

Q.7. How slotted ALOHA is different from Pure ALOHA?

Q.8. State the difference between circuit and packet switching.

Q.9. How transport layer ensures Qo5 (Quality of Service)?

Q.10. What is passive mode of FTP (File Transfer Protocol)?

PART-B **[5x8=40]**

(Analytical/Problem solving questions)

Attempt any five questions

Q.1. Discuss M/M/1 queuing model in detail. Also derive the steady state probability distribution for the number of customers in an M/M/1 queue.

Q.2. How does TCP handle flow control using the sliding window mechanism? Explain with the help of an example.

Q.3. Compare IPV4 and IPV6 in terms of addressing and header format.

Q.4. Compare distance vector and link-state routing protocols. Which one is more scalable and why?

Q.5. Explain CSMA (Carrier Sence Multiple Access) and why it is preferred in wired Networks.

Q.6. With the help of suitable diagram, Explain how DNS resolves domain names to IP address?

Q.7. Explain how SMTP, PoP3 and IMAP work together to send and retrieve emails?

PART-C **[4x15=60]**

(Descriptive/Analytical/Problem Solving/Design questions)

Attempt any four questions

Q.1. A company's email system is under SPAM attack. What security mechanism at application layer be adopted to mitigate this attack?

Q.2. Compare and contrast TCP and UDP. When should each be used?

Q.3. Differentiate between IEEE 802.3 (Ethernet) and IEEE 802.11 (Wi Fi).

Q.4. With the help of suitable diagram explain working of Remote Procedure Call (RPC).

Q.5. Explain the role of MAC (Media Access Control) addressing in IEEE 802.3 networks.

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Total No. of Questions : 22 Total No. of Pages : 04

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6E1595

B.Tech. VI-Sem. (Back) Exam. - 2025

ELECTRONICS & COMM. ENGG.

6EC 4-05 Information Theory and Coding

Time : 3 Hours Maximum Marks : 120

Instructions to Candidates :

Attempt all ten questions from Part-A, five questions out of seven questions from Part-B and four questions out of five questions from Part-C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in Form No. 205)

1. ..... 2. .....

PART-A [10x2=20]

(Answer should be given up to 25 words only)

All questions are compulsory

Q.1. What do you mean by Entropy?

Q.2 Define an Average Information.

Q.3. What do you mean by discrete memoryless service?

Q.4. Define Markov Source.

Q.5. Explain in brief the Information Rate.

Q.6. What is the need of Encoding?

Q.7. What is the performance measuring factor for the encoder?

Q.8 What is the Shannon limit?

Q.9. State any one property of a Linear code.

Q.10. What is the critical rate in a Noisy channel coding theorem?

PART-B [5x8=40]

(Analytical/Problem-solving Questions)

Attempt any five questions

Q.1. Explain the following types of Entropies (any two) : [2×4=8]

(i) Joint Entropy

(ii) Differential Entropy

(iii) Conditional Entropy

Q.2 Explain the Shannon's noiseless coding theorem with suitable mathematical expressions. [8]

Q.3. A source puts one of five possible messages during each message interval. The probabilities of these message are $p_1 = \frac{1}{2}$, $p_2 = \frac{1}{4}$, $p_3 = \frac{1}{4}$, $p_4 = \frac{1}{16}$, $p_5 = \frac{1}{16}$.

What is the information content of these messages? [8]

Q.4. Consider a discrete memoryless source with a source alphabet $A = \{S_0, S_1, S_2\}$ with respective probablities $p_0 = \frac{1}{4}$, $p_1 = \frac{1}{4}$, $p_2 = \frac{1}{2}$. Find the entropy of the source. [8]

Q.5. Consider a Binary Erasure Channel (BEC) as shown in figure 1 with transition probabilities matrix given by: [8]

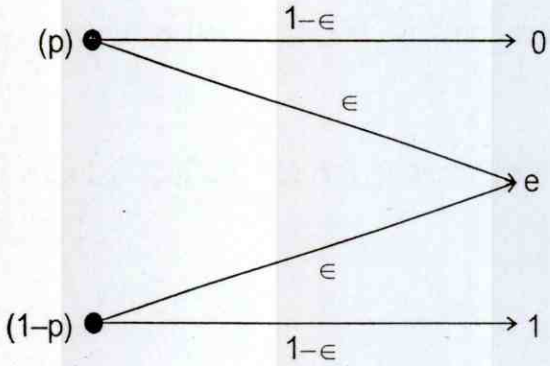

Figure 1 (BCE)

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

Calculate the capacity of this BEC.

Q.6. State both the statements of Noisy channel coding theorem and explain. [8]

Q.7. Mention the various steps of the Huffman coding algorithm.

PART-C [4x15=60]

(Descriptive/Analytical/Problem-solving/Design Questions)

Attempt any four questions

Q.1. Consider a binary symmetric channel (BSC) as shown in figure-2. It makes an error occasionally with probability 'p'. Let X and Y be binary randum variables that represent the input and output of this BSC. Let the input symbols be equally likely and O/P symbols depends upon the input. Calculate the mutual information about the occurrence of the event $X = 0$ given that $Y = 0$, $I(x_0; y_0) = I(0; 0)$. [15]

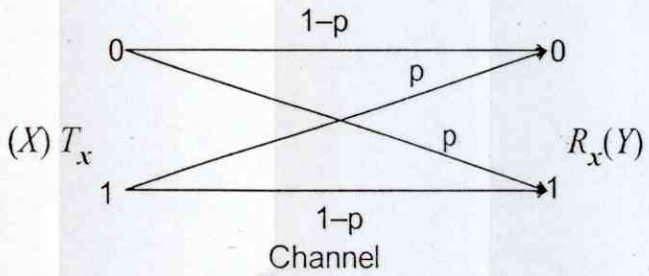

Figure-2 (BSC)

Q.2 Consider a DMS (Discrete Memoryless Source) with Seven possible symbols $x_i = 1, 2, 3, 4, ...,7$ and the corresponding probablities $P(x_1)=0.46$, $P(x_2)=0.30$, $P(x_3)=0.12$, $P(x_4)=0.06$, $P(x_5)=0.03$, $P(x_6)=0.02$, $P(x_7)=0.01$. Calculate the entropy of the source for Huffman coding, $H(x)$ as well as the average nos. of binary digits per symbol $\bar{R}$. [15]

Q.3. In connection to Shennon's channel capacity theorem, define the following forms with brief explanation : [4+4+4+3=15]

(i) Shannon Limit

(ii) Capacity boundary

(iii) Bit Error Rate (BER)

(iv) Bandwidth Efficiency Diagram

Q.4. Write short notes on the following (any three) : [5×3=15]

(i) Cyclic Codes

(ii) Convolutional Arithmetic Codes

(iii) Huffman Coding

(iv) Techniques of Decoding

Q.5. Explain Viterbi decoding with suitable examples. Also explain the application of Viterbi decoding. [15]

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6E1596

Total No. of Questions : 22 Total No. of Pages : 04

Roll No. : .....

6E1596

B. Tech. VI-Sem. (Back) Exam, May 2025

Electronics and Comm. Engg.

6EC 5-11 Introduction to MEMS

6E1596

Time: 3 Hours **Maximum Marks: 120**

Instructions to Candidates :

Attempt all ten questions from Part-A, five questions out of seven questions from Part-B and four questions out of five from Part-C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

Use of following supporting materials is permitted during examination. (Mentioned in Form No. 205)

1. ..... 2. .....

PART-A [10×2=20]

Answer should be given up to 25 words only. All questions are compulsory. Each question carries 02 marks.

Q.1. Define MEMS and provide two examples of MEMS devices.

Q.2. What is the typical size range of components in MEMS devices ?

Q.3. Briefly mention one significant historical development that led to the field of MEMS.

Q.4. State Hooke's Law as it applies to the mechanics of solids.

Q.5. What is Poisson's effect ?

Q.6. Define Linear Thermal Expansion and give its formula.

Q.7. What is the basic principle behind energy methods in mechanics ?

Q.8 List of two common deposition techniques used in MEMS fabrication.

Q.9. What does LIGA stand for in the context of lithography ?

Q.10. Write the name of sensors and actuators used in MEMS.

PART-B [5x8=40]

Analytical / Problem solving questions. Attempt any five questions.
Each question carries 8 marks.

Q.1. Write a short note on applications of MEMS/NEMS.

Q.2. Explain the concept of scaling effects in MEMS. How does the surface area to volume ratio change as the dimensions of a device are scaled down?

Q.3. Describe the basic steps involved in a surface micromachining process using a sacrificial layer. Illustrate with a schematic diagram.

Q.4. Explain the phenomenon of Stiction in MEMS devices. What are the primary causes of stiction ? Suggest two methods to mitigate it.

Q.5. Briefly explain the principle of operation of a piezoresistive pressure sensor (a micro/nano sensor).

Q.6. Describe the process of anisotropic etching of Silicon. Explain why certain etchants exhibit anisotropic behaviour and provide one example of an anisotropic etchant for Silicon.

Q.7. Explain the concept of modeling coupled electromechanical systems in MEMS. Provide an example of a MEMS device where electrical and mechanical domains are strongly coupled.

PART-C [4x15=60]

Descriptive / Analytical / Problem solving / Design questions.

Attempt any four questions. Each question carries 15 marks.

Q.1. Discuss overview of the Finite Element Method (FEM) and its importance in the design and analysis of MEMS structures. Explain the steps involved in a typical FEM analysis.

Q.2. Compare and contrast surface micromachining and bulk micromachining techniques for fabricating MEMS devices. Discuss their respective advantages, disadvantages, and typical applications.

Q.3. Describe the photolithography process (excluding LIGA) used in MEMS fabrication. Explain the steps involved, including photoresist coating, exposure, and development. What factors influence the resolution of the lithographic process ?

Q.4. Explain the process of wafer bonding in MEMS fabrication. Discuss two different types of wafer bonding techniques and their applications.

Q.5. Write short notes on **any two** form the following :

(i) Micromachining techniques

(ii) Deposition techniques

(iii) MEMS Sensors

(iv) Actuators.

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6E7155

Total No. of Questions : 22 Total No. of Pages : 08

Roll No. : .....

6E7155

B.Tech. VI-Sem. (Back) Exam., May–2025

ELECTRONICS AND COMMUNICATION ENGG.

6EC 4-05/ Information Theory and Coding

(Only for Back)

Time : 3 Hours **Maximum Marks : 70**

Instructions to Candidates :

Attempt all ten questions from Part-A, five questions out of seven questions from Part-B and three questions out of five questions from Part-C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in Form No. 205)

1. ..... 2. .....

PART-A **[10x2=20]**

(Answer should be given up to 25 words only)

All questions are compulsory

Q.1. What do you mean by Swimming path of Viterbi decoding? [2]

Q.2. Define Information content of a symbol. [2]

Q.3. Explain about the error detection and error correction capabilities of Hamming codes. [2]

Q.4. What do you mean by syndrome of linear block codes? [2]

Q.5. Define the basic properties of Galois Field. [2]

Q.6. What is the difference between block, codes and convolutional codes? [2]

Q.7. What is the significance of prefix code in source coding? [2]

Q.8. Define Information Rate. [2]

Q.9. State Source coding theorem. [2]

Q.10. State the properties of entropy. [2]

PART-B **[5x4=20]**

(Analytical/Problem-solving Questions)

Attempt any five questions

Q.1. Given a telegraph source having two symbols dot and dash. The dot duration is 0.2 sec. The dash duration is 3 times the dot duration. The probability of the dots occurring is twice that of the dash, and time between the symbols is 0.2 sec. Calculate the Information rate of the telegraph source. [4]

Q.2. Two Binary symmetric channels (BSCs) are connected in cascade as shown in Fig-1.

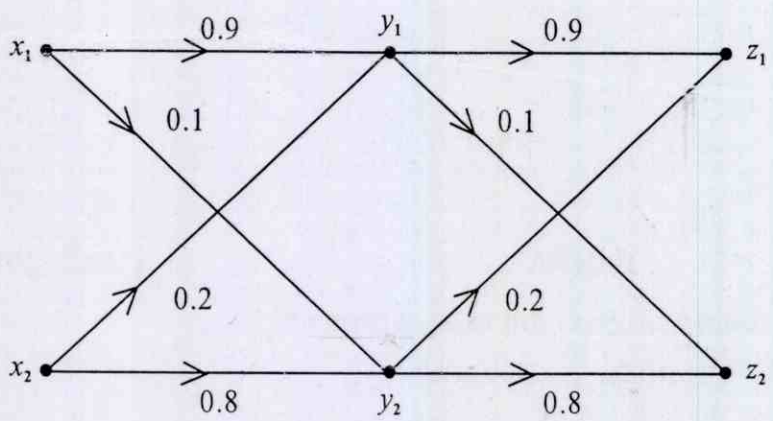

Fig. 1

(i) Find the overall channel matrix of the resultant channel and draw the resultant equivalent channel diagram.

(ii) Find $P(Z_1)$ and $P(Z_2)$ when $P(x_1) = P(x_2) = 0.5$ [3+1=4]

Q.3. For a (6,3) code, the generator matrix G is given by :

$$G = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 \end{bmatrix}$$

(i) Realize an encoder for this code.

(ii) If the received codeword is 100011 find the syndrome. [2+2=4]

Q.4. Design a syndrome calculator for a (7,4) cyclic Hamming code generated by the polynomial $G(p) = p^3 + p + 1$. Calculate the syndrome for $Y = (1001101)$. [2+2=4]

Q.5. The second order extension of Discrete Memoryless Source (DMS) X denoted by X^2, is formed by taking the source symbols two at a time. The coding of this extension has been shown in Table-1. Find the efficiency x and redundancy y of this extension code. [2+2=4]

a_i	$P(a_i)$	code
$a_1 = x_1 x_1$	0.81	0
$a_2 = x_1 x_2$	0.09	10
$a_3 = x_2 x_1$	0.09	110
$a_4 = x_2 x_2$	0.01	111

Q.6. The generator polynomial of a (7,4) cyclic code is $G(p) = p^3 + p + 1$. Find all the code vectors and generator matrix for the code systematic form of cyclic code. [2+2=4]

Q.7. Explain the Viterbi decoding or maximum likelihood decoding with an example. [4]

PART-C

[3x10=30]

(Descriptive/Analytical/Problem Solving/Design Question)

Attempt any three questions

Q.1. A DMS X has seven symbols $x_1, x_2, x_3, x_4, x_5, x_6$ and x_7 with probabilities :

$P(x_1) = 0.05$ $P(x_2) = 0.15$ $P(x_3) = 0.2$

$P(x_4) = 0.05$ $P(x_5) = 0.15$ $P(x_6) = 0.3$

$P(x_7) = 0.1$

(i) Construct a Shannon Fano code for X and calculate the efficiency of the code. [5]

(ii) Repeat for the Huffmann code and compare the results. [5]

Q.2. For a convolutional encoder shown in Fg. 2. Sketch the state diagram and Trellis diagram. Determine the output data sequence for the input data sequence of 10110. [3+3+4=10]

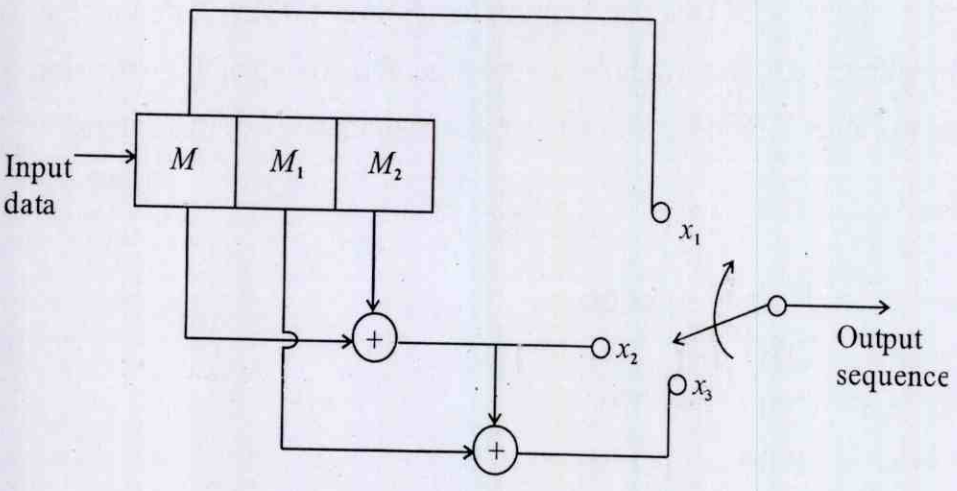

Fig. 2

Q.3. Given a Binary Symmetric Channel (BSC) as shown in fig. 3. with $P(x_1) = \alpha$:

(i) Show that the mutual information

I (X;Y) is given by

$I(X;Y) = H(Y) + P \log_2 P + (1-P) \log_2 (1-P)$ [5]

(ii) Calculate I(X;Y) for $\alpha = 0.5$ and $P = 0.1$ [3]

(iii) Repeat part (ii) for a = 0.5 and P = 0.5 and comment on the result Fig. 3. shows the diagram of the Binary Symmetric Channel (BSC) with associated input probabilities. [2]

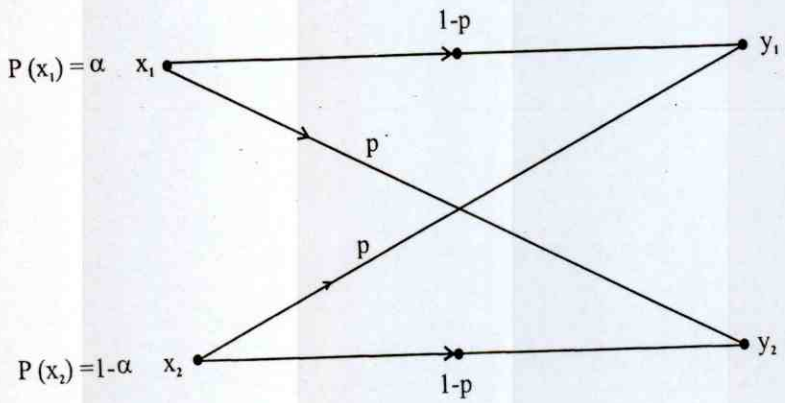

Fig. 3.

Q.4. (i) Consider a binary memoryless source X with two symbols x_1 and x_2 Prove that H(X) is maximum when both x_1 and x_2 are equiprobable. [5]

(ii) A high resolution black and white TV picture consists of about 2×10^6 picture elements and 16 different brightness levels. Pictures are repeated at the rate of 32 per second. All picture elements are assumed to be independent, and all levels have equal likelihood of occurence. Calculate the average rate of information conveyed by this TV picture source. [5]

Q.5. (i) Differentiate between systematic and non-systematic codes. Also give suitable example. [8]

(ii) Write the advantages and disadvantages of cyclic code. [2]

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