Khulna University of Engineering & Technology
B. Sc. Engineering 4th Year 1st Term (Regular) Examination, 2017
Department of Electrical and Electronic Engineering
EE 4105

Communication Engineering-II

Time: 3 hours Full Marks: 210

N.B.: (i) Answer **ANY THREE** questions from each section in separate scripts.
(ii) Figures in the right margin indicate full marks.

Section A

Q1. (a) What are Telephony and Telegraphy? Describe the operation of a carbon granule microphone. What is the importance of steady current flowing through a carbon microphone? Answer with necessary mathematical expression. (14)

(b) What is the significance of sidetone in a telephone conversion? Explain the operation of hybrid circuit to control the sidetone. (12)

(c) A central battery exchange is powered with a 48 V battery. The carbon microphone requires a minimum of 24 mA as energising current. The battery has a 400 Ω resistance in series for short circuit protection. The dc resistance of the microphone is 50 Ω. If the cable used for subscriber lines has the diameter of 0.064 cm, determine the maximum distance at which a subscriber station can be located. (09)

Q2. (a) How the switching systems can be classified? With necessary diagrams, explain the operation of cross bar switching technique. What is the main limitation of cross bar switching? Using suitable example explain how this limitation can be overcome using diagonal cross point matrix. Use necessary illustrations. (14)

(b) Explain different modes of SPC exchange. Answer with necessary illustrations. (10)

(c) Tabulate the difference between circuit and message switching. (04)

(d) Classify digital switching systems. How the number of switching elements is reduced by multistage switching than single stage switching? Answer with necessary illustrations and examples. (07)

Q3. (a) Show the typical telephone traffic pattern as a function of time. Define the terms: BHCA, CCR, and GoS. (09)

(b) Explain network topologies with relative advantages and disadvantages. (12)

(c) During a busy hour, 1400 calls were offered to a group of trunks and 10 calls were lost. The average call duration has 5 minutes. Find traffic offered, traffic carried, GoS, and the total duration of period of congestion. (08)

(d) Write short notes on–(i) BLUETOOTH, (ii) ISDN, and (iii) INTERNET. (06)

Q4. (a) What is optical fiber communication? Show its typical construction. Define the terms: critical angle, acceptance angle, and numerical aperture. (09)

(b) How a concentrated beam of light is obtained from a heterostructure LED?–Explain with proper schematics. (13)

(c) Write down the names of different dispersion occur in fiber optic waveguide. What are the losses occur in silica fiber? Show the typical loss vs. wavelength curve of silica fiber. (06)

(d) What is a PD? Show the basic structure of an optical receiver with different noises. (07)

Section B

Q5. (a) Describe the basic principle of cellular mobile system. Also describe the functions of the components of the system. (13)

(b) How the capacity of a mobile system can be increased by frequency reuse planning?–Show mathematically. Also write down the name of the processes of improving coverage area in cellular communication system. (12)

(c) Briefly explain handoff and call drop situation with necessary schematics. (10)

Q6. (a) What is meant by interference in a cellular system? Calculate the co-channel interference of first tier of 6 interferers (first tier). Also compare with that from 12 interferers (both first and second tiers). (15)

(b) What are basic propagation mechanisms? Prove that the received power at a distance from the transmitter for two-ray ground reflection model is $P_r = \frac{P_t G_t G_r h_t^2 h_r^2}{d^4}$, where the symbols have their usual meanings. (15)

(c) Why hexagonal cells are used rather than circular or square?–Explain schematically. (05)

Q7 (a) Shortly explain GSM system structure and GSM functions. (12)

(b) Why compression is required in multimedia communication? Write down the basic differences between LTE and 4G. (09)

(c) Describe the principle of CDMA system. Why does the system capacity of CDMA system reduce during handoff. (08)

(d) Consider GSM, which is a TDMA/FDD system that uses 30 MHz for the forward link, which is broken into radio channels of 200 kHz. If 8 speech channels are supported on a single radio channel, and if no guard band is assumed, find the number of simultaneously users that can be accommodated in GSM. (06)

Q8 (a) Write down the criteria of link budget of a satellite system. Which parameters require more attention during link budget calculations? (12)

(b) What is RADAR? Clearly sketch the RADAR block diagram and shortly describe the functions of each component. (11)

(c) Write short notes on–(i) GPS, (ii) MEO, and (iii) Priority schemes in single traffic system. (12)

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VLSI Design and Technology

Time: 3 hours Full Marks: 210

N.B.: (i) Answer **ANY THREE** questions from each section in separate scripts.
(ii) Figures in the right margin indicate full marks.

Section A

Q1. (a) What is the difference between semi custom and full custom design? Describe the top down design hierarchy for full custom VLSI design. (13)

(b) Deriving the expression for edge lines for nMOS inverter with a depletion load, show that speed of this circuit is dependent on transistor geometry. (15)

(c) The following data are given for an nMOS inverter with resistive load $V_p = 4$ V; $V_t = 1$ V; V_{out} (low) = 0.2 V; $\frac{\epsilon\mu}{D} = 40\ \mu A/V^2$. Calculate the value of load resistance *R* considering minimum geometry transistor. (07)

Q2. (a) What is meant by design rules for chip design? State and explain λ-based design rules with necessary diagram. (12)

(b) What are pass transistor and transmission gate? Briefly explain their importance in VLSI design using suitable examples. (07)

(c) Design a 4-bit bus arbitration logic circuit using both conventional and structural design approaches. Also draw the mask layout of the basic cell. (16)

Q3. (a) Design a MOS based static D flip flop with set and reset options and explain the working principle of your design. (10)

(b) What is RAM? Design a CMOS based three-transistors RAM cell and estimate its storing capacity considering 1 sq-cm chip size and 0.9 μm technology. (15)

(c) Draw the circuit diagram of a 4×4 barrel shifter and explain its operation. (10)

Q4. (a) Write short notes on the following special logic concepts: (10)
(i) C^2MOS logic and (ii) Pseudo-nMOS logic.

(b) What are the advantages of BiCMOS inverter? Design a BiCMOS inverter with better output logic levels. (08)

(c) Explain the precharged bus concept using suitable diagram. (08)

(d) Describe different bus architecture concepts for microprocessor design using necessary diagrams. (09)

Section B

Q5. (a) Discuss the significance of device miniaturization in the development of modern technology. Does Moore's law still hold it true? Justify your answer. (12)

(b) Write down the basic processing steps of bipolar manufacturing technology. (07)

(c) What do you mean by bulk growth? Why is it so important? Explain the CZ method for bulk growth. (16)

Q6. (a) What is the importance of epitaxy in IC fabrication? Briefly explain the MBE growth process. (10)

(b) What do you mean by photo-lithography? Briefly explain photo-lithographic process used in IC fabrication. (10)

	(c)	What do you mean by annealing and passivation. Explain in brief.	(07)
	(d)	Briefly explain ion implantation doping technique.	(08)
Q7	(a)	Why is the twin-tub process called so? Explain using necessary diagram.	(08)
	(b)	Define self-aligned gate. What do you mean by oxide-isolation and silicon-on-sapphire CMOS process?	(09)
	(c)	Explain the silicon gate CMOS fabrication process with necessary diagrams.	(18)
Q8	(a)	Write down the features of GaAs technology over Si technology. Why GaAs devices are known as ultra-fast VLSI devices?	(10)
	(b)	What is the significance of Schottky barrier in the operation of GaAs devices?	(05)
	(c)	Write down the names of so called first generation and second generation devices. Also show the evolution of process complexity in terms of mask count as a function of time for both silicon and gallium arsenide technology.	(09)
	(d)	Define MESFET. Explain the fabrication process of E-MESFET using necessary diagrams.	(11)