G 705 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

Seventh Semester

Branch : Electronics and Communication Engineering

EC 010 701—VLSI DESIGN (EC)

(Improvement/Supplementary)

[2010 admissions]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. Discuss the need for an epitaxial layer.
2. Write a note on vias.
3. Discuss the features of CPL.
4. Explain the features of BiCMOS Technology.
5. Explain the advantages of the use of FPGA in IC design.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Write a note on metallization.
7. Explain the advantages of Si gate technology.
8. Explain latchup in CMOS.
9. Explain how the electrical and physical parameters of CMOS transistor vary with scaling.
10. Explain channeling effect.

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*
Each question carries 12 *marks.*

11. Explain Czochralski process. Give the features of Cz grown Si. (12 marks)

Or

12. Explain the process of ion implantation. (12 marks)

Turn over

13. Explain the different techniques used in the isolation of components in IC fabrication. (12 marks)

Or

14. Explain the design of monolithic resistors and capacitors. (12 marks)

15. Discuss the implementation of a XOR gate using CMOS logic. Implement the same using TG. Compare them. (12 marks)

Or

16. Explain stick diagrams and their use in IC layout. Draw the stick diagram of a two input NAND gate. (12 marks)

17. (a) Explain the implementation of JKFF using CMOS logic. (6 marks)

(b) Explain the concept of scaling. Can this be directly implemented in practice. If Yes/No explain. (6 marks)

Or

18. (a) Explain the structure of BiCMOS two input NOR gate. Compare it with its CMOS counterpart. (7 marks)

(b) Explain the VI characteristics of a CMOS inverter. (5 marks)

19. (a) Explain the doping process of a GaAs crystal. (7 marks)

(b) Write a note on PLDs. (5 marks)

Or

20. (a) Explain the crystal structure of GaAs. (7 marks)

(b) Compare Si and GaAs technologies. (5 marks)

[5 × 12 = 60 marks]

G 633 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

Seventh Semester

Branch : Electronics and Communication Engineering

MICROWAVE AND RADAR ENGINEERING (L)

(Old Scheme – Prior to 2010 Admissions)

[Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each question carries 4 *marks.*

1. Explain the two-hole directional coupler and determine the S-matrix.
2. Explain the working of Isolator.
3. Draw the various slow wave structures of TWT.
4. With neat sketch, explain Reflex Klystron Oscillator.
5. Explain the working of IMPATT diode.
6. Differentiate between Microwave transistors and TED's.
7. Explain Radar Range Equation.
8. With diagram, explain Simple CW Radar.
9. Explain Radio direction finders.
10. Explain LORAN.

(10 × 4 = 40 marks)

Part B

Answer **all** *questions.*

Each question carries 12 *marks.*

11. Explain the basic characteristics of Magic Tee. Derive the S-matrix for an ideal matched Magic Tee.

Or

12. Discuss the characteristics, features and applications of microwaves.

Turn over

13. Explain in detail the operation and application of Magnetron.

Or

14. Explain with neat block diagram of microwave transmitter and receiver.

15. Explain the different modes of operation of Gunn diode with neat diagrams.

Or

16. Explain the operational principles of :

    (a) TRAPATT diode.

    (b) INP diode.

17. With block diagram, explain :

    (a) FMCW radar.

    (b) HTI radar.

Or

18. Explain with block diagram, pulse doppler radar.

19. Explain different types of microwave antenna.

Or

20. Explain (a) GPS ; (b) LORAN.

(5 × 12 = 60 marks)

G 644 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

Seventh Semester

Branch : Electronics and Communication Engineering

OPTICAL FIBRE COMMUNICATION SYSTEM (L)

(Old Scheme – Prior to 2010 Admissions)

[Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each question carries 4 *marks.*

1. Explain : Numerical aperature and V number.
2. Define : (a) Refractive index ; (b) Dispersion.
3. Distinguish between Step index and Graded index fibers.
4. Explain the different modes in fiber propagation.
5. What is lasing threshold?
6. Explain Line width modulation.
7. Explain the concept of optical filters in WDM.
8. Explain Internal Quantum Efficiency and External Quantum Efficiency.
9. What is the function of OTDR?
10. What is cut-off wave length? How can we measure it?

(10 × 4 = 40 marks)

Part B

Answer **all** *questions.*

Each question carries 12 *marks.*

11. "Optical fiber can act as a wave guide". Justify the statement.

Or

12. Define : (a) Acceptance angle ; (b) Acceptance cone ; (c) Critical angle ; (d) Skew Ray.

Turn over

13. Explain the different attenuation mechanism in optical fibers.

Or

14. What is intermodal dispersion? Explain the concept of dispersion shiftened and dispersion flattened fibers.

15. Compare Direct detection scheme with Coherent detection scheme. How coherent detection is superior?

Or

16. Compare the performance of LED with LASER Diode. And explain the working of Edge emitting LED.

17. With neat sketch, explain the features of Doped fiber amplifiers, with special reference to EDFA.

Or

18. Explain in detail, any *one* type of optical fiber network.

19. Explain a method to measure band width in optical fibers.

Or

20. Suggest a method to measure attenuation in optical fibers and explain its working.

(5 × 12 = 60 marks)

G 624 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

Seventh Semester

Branch : Electronics and Communication Engineering / Applied Electronics and Instrumentation

VLSI TECHNOLOGY (LA)

(Old Scheme – Prior to 2010 Admissions)

[Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each question carries 4 *marks.*

1. Discuss the different steps in crystal shaping process.
2. Explain Fick's laws of diffusion.
3. Write a note on the fabrication of MOS resistors.
4. What are the differences in process steps in the fabrication of Si gate MOSFET compared to a metal gate MOSFET?
5. Briefly discuss constant field scaling.
6. Discuss the design rules for Vias and Metal 1.
7. Explain the transfer characteristics of an Inverter.
8. Explain the physical origin of latch up in CMOS transistors. How is it triggered and how can it be prevented?
9. Write a note on Channelling.
10. Discuss the need for device modelling. What are the minimum requirements to be taken care?

(10 × 4 = 40 marks)

Part B

Answer **all** *questions.*

Each question carries 12 *marks.*

11. Explain the need for epitaxial growth. Discuss the CVD process for epitaxial growth.

Or

12. Explain the process of ion implantation in detail. What are its advantages?

Turn over

13. (a) Explain the different steps employed to control the V_T of a MOS structure.

    (b) Write a note on IC cross over and Vias.

(9 + 3 = 12 marks)

Or

14. Explain the different isolation techniques used in IC fabrication. Give their features.

15. Explain a twin well CMOS process with neat sketches.

Or

16. Explain Short channel effects and Reverse short channel effects.

17. Draw the schematic and layout of a 2-input NOR gate.

Or

18. Explain the design of a 4-bit barrel shifter.

19. Explain the issues in a submicron process. What are the steps that can be taken to address these?

Or

20. Explain the doping process of a GaAs crystal.

[5 × 12 = 60 marks]

G 614 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

Seventh Semester

Branch : Electronics and Communication Engineering / Applied Electronics and Instrumentation

MICROCONTROLLER BASED SYSTEM DESIGN (L A)

(Old Scheme – Prior to 2010 Admissions)

[Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each question carries 4 *marks.*

1. What is the basic architecture of a PLA? How is the capacity of PLA specified?
2. What are the features of FPGA?
3. Discuss the features of Embedded C compiler.
4. Show how a seven segment display can be interfaced to a microcontroller.
5. Explain how Analog to Digital converters are classified.
6. Show how a DAC can be interfaced to the microcontroller.
7. Discuss about the Serial Bus standards.
8. Compare the various Serial communication standards.
9. Explain the function of a "Watchdog timer".
10. Discuss the measurement of power factor, using a microcontroller.

(10 × 4 = 40 marks)

Part B

Answer **all** *questions.*

Each question carries 12 *marks.*

11. (a) What are the various logic families?

    (b) Compare the features of PLA, PAL and GAL.

(6 + 6 = 12 marks)

Or

Turn over

12. (a) Discuss a dual port RAM.

(b) Explain the realization of PAL with flip-flop.

(5 + 7 = 12 marks)

13. (a) Compare the architecture of 89 C 2051 and 89 C 51 microcontrollers.

(b) Write a short note on memory models.

(8 + 4 = 12 marks)

Or

14. (a) Design a traffic light control system using a microcontroller.

(b) Discuss the circuit diagram and necessary algorithm.

(7 + 5 = 12 marks)

15. (a) Discuss the interfacing of an Analog to Digital Converter with a microcontroller.

(b) What are the typical ICs used for ADC.

(8 + 4 = 12 marks)

Or

16. (a) Design a temperature control system using a microcontroller.

(b) Discuss the Interfacing program using C.

(8 + 4 = 12 marks)

17. (a) Compare I^2C bus with SPI bus.

(b) Explain the features of 3 wire serial EEPROM.

(6 + 6 = 12 marks)

Or

18. (a) Draw the interfacing diagram of MAX 232 line driver/receiver to a microcontroller.

(b) What is a Universal Serial Bus? Explain.

(7 + 5 = 12 marks)

19. (a) Show how a matrix keyboard can be interfaced to a microcontroller.

(b) Explain the principle of d.c. motor speed control with a microcontroller.

(6 + 6 = 12 marks)

Or

20. (a) Discuss how frequency can be measured using a microcontroller.

(b) Show the interfacing of a DS 1302 Real time clock.

(7 + 5 = 12 marks)

[5 × 12 = 60 marks]

G 776 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

Seventh Semester

Branch : Electronics and Communication Engineering

EC 010 706 (L) 03—DIGITAL IMAGE PROCESSING (Elective II) [EC]

(Improvement/Supplementary—2010 admissions)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. Name different classes of Digital Images.
2. Define 2D-DFT. List its properties.
3. Name the role of point operators in image enhancement.
4. Mention the uses of derivative operation in edge detection.
5. Give an example of runlength coding.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Define luminance and brightness of an image.
7. What is the special feature of KL transform.
8. What are digital negatives ? Mention the use of it.
9. What are gradient operators ? Explain its use in edge detection.
10. Sketch the block diagram of the encoders used in lossy and lossless predictive coding.

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*
Each question carries 12 *marks.*

11. (a) State and prove 2D-sampling theorem.

Or

(b) Explain the following :

(i) Aliasing in band limited images.

(ii) Image quantization.

(iii) Elements of visual perception.

12. (a) (i) Construct Haar transform for N = 4.

(ii) Find 8-point DCT of the following data :

$X = \{2, 4, 6, 8, 10, 6, 4, 2\}$

Or

(b) Find KL transform to express co-variance matrix C_X, Eigen values $\lambda_1, \lambda_2, \lambda_3$ transformation matrix A_X and covariance matrix C_Y of the transformed vectors, for the given data :

$$X = \begin{bmatrix} 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}.$$

13. (a) (i) Explain non-linear noise cleaning procedure and describe how it provides better trade-off between noise smoothing, while retention of fine image details, compared to linear processing techniques.

(ii) What is a median filter ? Explain its operation on a 2D-noisy image with uniform noise.

Or

(b) (i) List different histogram image enhancement techniques. Explain each one in detail.

(ii) Write a technical note on colour image enhancement.

14. (a) (i) What is clustering ? Explain its role in the feature extraction of multi featured images.

(ii) With block diagram, explain Coleman-Andrews clustering image segmentation process.

Or

(b) Explain the following algorithms used for edge linking :

(i) Hough transform.

(ii) Greedy algorithm and loop free algorithm for segmentation.

15. (a) (i) Differentiate between lossy and lossless image compression standards.

(ii) Using block diagram, explain the working of vector quantization.

Or

(b) Explain the following image compression standards :

(i) JPEG standards.

(ii) MPEG-1, MPEG-2, MPEG-4 and MPEG-7.

(5 × 12 = 60 marks)

G 729 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

Seventh Semester

Branch : Electronics and Communication Engineering

EC 010 703 – MICROWAVE ENGINEERING (EC)

(2010 Admissions)

[Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each question carries 3 *marks.*

1. Write down any four applications of microwaves.
2. Write down the significance of inter electrode capacitances in conventional vacuum tubes at microwave frequencies.
3. What is Avalanche multiplication effect?
4. Why is it not possible to measure power at microwave frequencies using wattmeters?
5. Write down the important Microwave Integrated Circuit fabrication technologies.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*

Each question carries 5 *marks.*

6. Explain the division of power among various arms of a shunt Tee Junction.
7. Draw the Applegate diagram of a reflex klystron.
8. Comment on the uses of transistors at microwave frequencies.
9. Define Insertion loss with mathematical expressions.
10. Write down the advantages and disadvantages of Planar transmission lines.

(5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*

Each question carries 12 *marks.*

11. Derive the relation between ABCD and Y parameters and express ABCD parameters in terms of Y parameters.

Or

12. Explain a four port circulator in detail and write down its S matrix.

13. Explain the constructional details of a TWT amplifier and also explain the formation of electron bunches in it.

Or

14. Explain the constructional details of a reflex klystron and also explain about different modes of oscillations in it.

15. Describe in detail about any form of IMPATT diode and draw its typical doping profile.

Or

16. What are parametric amplifiers? What are their advantages and limitations?

17. Explain the set up used for measuring the S parameters of a magic Tee.

Or

18. Draw and explain the experimental set up used for measuring return loss.

19. Describe the various steps involved in the fabrication of monolithic MIC's.

Or

20. Comment on and compare the losses occurring in conventional transmission lines and microstrip lines.

(5 × 12 = 60 marks)

G 740 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

Seventh Semester

Branch : Electronics and Communication Engineering

EC 010 704—ELECTRONIC INSTRUMENTATION (EC)

(Improvement/Supplementary)

[2010 Admissions]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. Explain the term instrument calibration.
2. Brief the principle of operation of piezoelectric transducer.
3. Explain the operation of Wein bridge.
4. How stripchart recorders are used in recording ?
5. Mention any *one* method, for the measurement of current, without disturbing the electrical circuit.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Describe the measurement system with the help of a neat block diagram.
7. Explain the principle of operation of ultrasonic transducers.
8. Explain the principle of operation of optocoupler.
9. Explain the working of a spectrum analyzer.
10. Brief the principle of measurement of pressure.

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*
Each question carries 12 *marks.*

11. Explain the performance characteristics of instrument.

Or

12. Discuss the classification of errors occur in measurement procedure.

Turn over

13. Explain the classification of transducers.

Or

14. Explain the principle of working of strain gauge.

15. Explain the block diagram of telemetry system.

Or

16. Compare FDM and TDM techniques.

17. Explain different recording techniques and X-Y recorder in detail.

Or

18. Explain the principle of PLC.

19. Discuss the techniques for PH measurement and pressure measurement.

Or

20. Explain the different methods for temperature measurement.

(5 × 12 = 60 marks)

G 750 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

Seventh Semester

Branch : Electronics and Communication Engineering

EC 010 705—EMBEDDED SYSTEMS (EC)

(Improvement/Supplementary)

[2010 Admissions]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. Discuss the figures of merit of an embedded system.
2. Compare Harvard architecture to Von Neuman architecture.
3. Differentiate between a PCI bus and PCIe bus.
4. Write a note on RTC.
5. Write a note on micro kernels.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Discuss why a PC is not considered as an embedded system.
7. Write a note on Caches.
8. Write a note on differential signalling. What are its advantages and disadvantages ?
9. Write a note on watchdog timers.
10. Write a note on pre-emptive scheduling.

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*
Each question carries 12 *marks.*

11. Explain memory selection for an embedded system with two case studies.

Or

12. Explain the process of embedded system development with examples.

Turn over

13. Explain IDE in detail.

Or

14. Explain the advantages of programming in assembly language.

15. Explain bus arbitration. Discuss the different bus arbitration schemes.

Or

16. Explain serial bus communication protocols.

17. (a) Write a note on L293 motor driver. (6 marks)

    (b) Write a note on DS 1302 RTC. (6 marks)

Or

18. (a) Explain DAC interfacing. (6 marks)

    (b) Explain how phase angle of a dc motor can be measured. (6 marks)

19. Explain different types of real time tasks with examples.

Or

20. (a) Write a note on memory management. (6 marks)

    (b) Explain the onion skin diagram of an operating system. (6 marks)

[5 × 12 = 60 marks]

G 717 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

Seventh Semester

Branch : Electronics and Communication Engineering

EC 010 702—INFORMATION THEORY AND CODING (EC)

(2010 Admissions)

[Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 marks.

1. Define entropy. List its properties.
2. What are optimal codes ? Explain.
3. Sketch the channel transition diagram of a binary symmetric channel.
4. Make mod-2 multiplication and mod-5 addition table.
5. Explain the basic principle of LDPC codes.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 marks.

6. Define channel capacity. Express the channel capacity of a BSC channel and make a plot of it.
7. Explain the importance of Kraft's inequality in forming instantaneous codes.
8. State and explain Shannon-Hartely theorem.
9. Define vector space and subspace and list the conditions for a selected set of vectors to be a subspace.
10. Give the characteristics of Hamming codes. Explain with an example.

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*
Each question carries 12 marks.

11. (a) Define mutual information. List three properties and derive it.

Or

(b) Determine different entropies of the joint probability matrix given below and verify various entropy relationships.

X \ Y				
	0.2	0	0.2	0
	0.1	0.01	0.01	0.01
	0	0.02	0.02	0
P(X, Y)	0.04	0.04	0.01	0.06
	0	0.06	0.02	0.2

12. (a) The probability of occurrence of seven symbols is given by $\frac{1}{15}$, $\frac{1}{15}$, $\frac{2}{15}$, $\frac{2}{15}$, $\frac{3}{15}$, $\frac{3}{15}$ and $\frac{3}{15}$ respectively. Encode this sequence using

(i) Shannon-Fano algorithm.

(ii) Huffman algorithm.

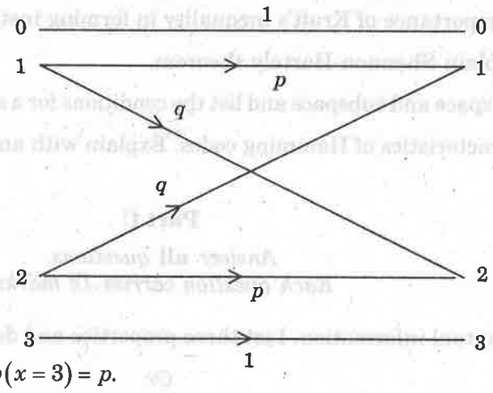
Or

(b) (i) Explain the steps involved in arithmetic coding.

(ii) In a text it was observed that the probability of occurrence of symbols $\{a, b, c\}$ are $\{0.4, 0.5, 0.1\}$. Use arithmetic coding to encode the string 'bbbc'.

13. (a) (i) Derive the channel capacity of a binary noiseless symmetric channel.

(ii) Calculate the capacity of the discrete channel shown in figure below. Assume $r = 1$ symbol/second.



$p(x = 0) = p(x = 3) = p.$

$p(x = 1) = p(x = 2) = Q.$

(b) (i) A Gaussian channel has a bandwidth of 4 kHz and a two-sided noise power spectral density $\eta/2$ of 10^{-14} watt/Hz. The signal power at the receiver has to be maintained at a level less than or equal to $\frac{1}{10}^{th}$ of a milliwatt. Calculate the capacity of this channel.

(ii) A black and white TV picture can be viewed as consisting of approximately 3×10^5 elements, each one of which may occupy one of ten distinct brightness levels with equal probability. Assume rate of transmission as 30 picture frames per second and S/N ratio is 30 dB. Calculate the minimum bandwidth required to support this video signal, using channel capacity theorem.

14. (a) The parity part of a G-matrix for a (7, 4) linear block code is given below :

$$[P] = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}$$

(i) Write G and H matrices.

(ii) Draw the encoder logic diagram.

(iii) Sketch the syndrome circuit and explain the decoding of the received vector of the input message 1011, if it is received with 5^{th} bit in error.

Or

(b) (i) Construct an extension field GF (2^4) of binary Galois field GF(2), using a primitive polynomial $p(X) = 1 + X + X^4$. Represent it in polynomial and 4-tuple formats.

(ii) If 'β' is a root of the polynomial $f(x)$ over GF(2), show that, the conjugates of 'β' are also roots of the same polynomial.

15. (a) For a (7, 4) cyclic encoder, given that the generator polynomial $g(X) = 1 + X + X^3$:

(i) Illustrate the systematic code generation for the input polynomial $u(X) = 1 + X^2 + X^3$.

(ii) Sketch the decoder logic diagram.

(iii) Describe the decoding of the received codeword corresponding to the transmitted codeword in part (i), is received with 4^{th} bit in error.

Or

(b) Sketch an encoder diagram of rate $\frac{1}{3}$, constraint length 3, systematic convolution encoder with $g^{(1)} = 101$, $g^{(2)} = 110$ and $g^{(3)} = 111$.

(i) Make a truth table, with present and next states.

(ii) Sketch the tree diagram and state diagram of this encoder.

(iii) Find the output of this encoder, for the input sequence 1010.

(5 × 12 = 60 marks)

G 656 **(Pages : 3)** **Reg. No.....**

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

Seventh Semester

Branch : Electronics and Communication Engineering

INFORMATION THEORY AND CODING (L)

(Old Scheme—Prior to 2010 Admissions)

[Supplementary]

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Each question in Part (a) carries 4 marks and in Part (b) carries 12 marks.

1. Define self information and mutual information. Give mathematical expressions and units in both case.
2. A source 'S' produces four alphabets A, B, C, D with corresponding probabilities $p_A = 0.5$, $p_B = 0.3$, $p_C = 0.15$ $p_D = 0.05$. Find entropy of the source and its second extension.
3. Sketch the transition matrix of binary erasure channel and derive the expression of channel capacity.
4. State and explain Shannon's source coding theorem.
5. What are instantaneous codes ? Give an example. Why they are called so ?
6. Explain zip coding algorithm with an example.
7. Discuss the error detection and correction capabilities of Hamming codes.
8. Give the general format of the generator polynomial of cyclic codes. Explain the method of making generator polynomial of (G, 4) cyclic codes.
9. What is interleaving ? Mention different types and uses of interviewers.
10. Derive the probability of error and throughput in the case of selective repeat ARQ stratergy.

(10 × 4 = 40 marks)

Part B

11. (a) Prove the following relations :—

    (i) $H(X, Y) = H(X) + H(Y/X)$.

    (ii) $I(X ; Y) = H(X) - H(X/Y)$.

    (iii) $I(X ; Y) = I(Y ; X)$.

(12 marks)

Or

Turn over

(b) Determine H (X), H (Y), H (X, Y), H (X/Y) and H (Y/X) for the joint probability matrix given below and using the values verify the relations among the given entropies :

$$P(X, Y) = \begin{array}{c} \\ X \end{array} \begin{array}{c} \begin{array}{cccc} Y & & & \end{array} \\ \begin{bmatrix} 0.2 & 0 & 0.2 & 0 \\ 0.1 & 0.01 & 0.01 & 0.01 \\ 0 & 0.02 & 0.02 & 0 \\ 0.04 & 0.04 & 0.01 & 0.06 \\ 0 & 0.06 & 0.02 & 0.20 \end{bmatrix} \end{array}$$

(12 marks)

12. (a) (i) Sketch a cascade of two binary symmetric channels and derive the relation of mutual information and compare it with a single stage binary symmetric channel.

(6 marks)

(ii) Derive the relationship for the capacity of a channel with infinite bandwidth.

(6 marks)

Or

(b) (i) State and prove Shannon-Hartley theorem. (4 marks)

(ii) Sketch the transition matrixes of a binary symmetric and unsymmetric channels. Derive the relation of Channel capacity C in both cases.

(8 marks)

13. (a) Consider a source with 8 alphabets, A to H, with respective probabilities 0.22, 0.20, 0.18, 0.15, 0.10, 0.08, 0.05 and 0.02. Construct a binary Huffman code and determine the code efficiency.

(12 marks)

Or

(b) A source S has 6 symbols with probabilities p_1 to p_6 such that $p_1 = 1/3$, $p_2 = 1/6$, $p_3 = \frac{1}{6}$, $p_4 = 1/6$, $p_5 = 1/12$. Find p_6 and then using Shannon-Fano coding method construct a binary code and determine the efficiency and redundancy of the code.

(12 marks)

14. (a) The generator matrix of a (6, 3) systematic linear block code is given as :

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

(i) Find all code vectors.

(ii) Sketch the encoder diagram.

(iii) Find the parity check matrix.

(iv) Find the error syndrome for single bit error patterns.

(12 marks)

Or

(b) Construct a systematic (7, 4) cyclic code using the generator polynomial $g(x) = x^3 + x + 1$. What is the error correcting capabilities of this code ? Construct the decoding table and determine the transmitted code word for the received code word 1101100.

(12 marks)

15. (a) Construct a (2, 1, 4) convolution encoder. Given $g^{(1)} = (1111)$ and $g^{(2)} = (1001)$ are the generator polynomials. Sketch its code tree and code trellis.

(12 marks)

Or

(b) Describe the following decoding methods used to decode a convolution code.

(i) ML decoding.

(ii) Sequential decoding.

(12 marks)

[5 × 12 = 60 marks]