



- (c) Consider a 3-error correcting (15, 5) binary BCH code with generator polynomial  $g(x)=1+x+x^2+x^4+x^5+x^8+x^{10}$ . The underlying field is  $GF(2^4)$  generated by  $g(y) = 1+y+y^4$ . Assume that the received polynomial is  $r(x)=x^3+x^7$ . Using the PGZ algorithm, find the error locator polynomial and the error locations. 8
- 7 (a) Why convolutional codes are called “convolutional”? 3
- (b) What is the fundamental difference between a convolutional code and a block code? 3
- (c) Compute the minimum distance of (2,1,2)-convolutional code, with output equations  $x_1= d_{j-2} + d_{j-1} + d_j$ , and  $x_2= d_{j-2} + d_j$ , where ‘+’ is addition over  $GF(2)$ . 10
- 8 (a) What is a concatenated code? 4
- (b) Describe the operations of block and convolutional interleavers. 6+6

-End-

**B.Tech. Examination 2022-23**  
**Electronics and Communication Engineering**  
**(Odd Semester Regular and Supplementary)**  
**Satellite Communication (ECEUGPE04/ECE415)**

Full Marks: 80

Time: 3.00 Hrs

- Answer all parts of a question in same place.
- Figures on the right hand side margin indicate full marks.
- Symbols have their usual meanings.

**Answer any Eight questions****Marks**

- |           |  |            |
|-----------|--|------------|
| <b>1.</b> | <b>Answer any 5 questions</b>  | <b>5x2</b> |
|           | (a) What are prograde and retrograde orbits? Why prograde orbit is mostly used?  |            |
|           | (b) Give examples of each of satellite services: FSS, BSS, MSS.  |            |
|           | (c) Define look angles of a satellite.   |            |
|           | (d) An amplifier has a quoted noise figure of 2.5 dB. What is the equivalent noise temperature?  |            |
|           | (e) Why amplitude modulation is never used in satellite communication?   |            |
|           | (f) What is the function of thruster motor in satellite?   |            |
|           | (g) Arrange in increasing order of coverage area of the satellites: LEO, GEO, MEO, HAP, MOLNIYA  |            |
|           | (h) Two satellites are at MEO orbits at a distance of 8000 km and 10000 km away from the earth, how their time periods of revolutions are related?   |            |
| <b>2.</b> | (a) State the Kepler's laws regarding orbital motion of satellites.  | 3          |
|           | (b) Assuming circular orbit, deduce the time period and orbital speed of a satellite at a height of 'h' above the earth of radius 'R'  | 3          |
|           | (c) A satellite is orbiting in a geosynchronous orbit of radius 42000 km. Find the velocity and time period of the satellite. Assume Gravitational Coefficient $g_0=398600.5 \text{ km}^3/\text{s}^2$ .  | 4          |
| <b>3.</b> | (a) Describe three principle sections and their functions in the structure of an active satellite.   | 5          |
|           | (b) Calculate the slant range of a geostationary satellite orbiting at 41000 km from an earth station making an elevation angle of $25^\circ$ . Also find the viewing angle of the satellite.  | 5          |
| <b>4.</b> | (a) What is the effect of solar pressure and solar eclipse on satellite communication?   | 2          |
|           | (b) Deduce the expression of angle of eclipse and duration of eclipse.   | 4          |
|           | (c) If a satellite is at a height of 41000 km and orbiting in equatorial plane, comment whether the satellite will be under eclipse on equinox days and find the duration of eclipse.  | 4          |
| <b>5.</b> | (a) What are the effects of ionospheric losses on satellite microwave signals?   | 2          |
|           | (b) With the help of equivalent noise model of the receiver section, deduce the expression of equivalent system noise temperature.   | 4          |
|           | (c) Calculate the noise temperature of a 6 GHz receiver system having gains and noise temperatures are as follows: $T_{in} = 75\text{K}$ , $T_{rf} = 75\text{K}$ , $T_m = 400\text{K}$ , $T_{if} = 1000\text{K}$ , $G_{rf} = 23\text{dB}$ , $G_m = 10 \text{ dB}$ and $G_{if} = 35\text{dB}$ . | 4          |
| <b>6.</b> | (a) What are the different losses an electromagnetic wave undergoes when carrying satellite signals? Deduce the expression of path loss in dB.   | 1+4        |

- (b) An earth station transmits at 5.62 GHz from an antenna of 6 m diameter. The transmitter generates an output of 6 kW. The satellite is 39920 km away from the earth station. The efficiency of transmitting antenna is 0.85. Calculate (i) path loss, (ii) transmitter power in dBW, (iii) EIRP, (iv) received power at the satellite. 5
7. (a) What are worst cases to consider at the time of link budget calculation? 3
- (b) A satellite downlink in C-band has various parameters as follows: transponder output power 20 W, antenna gain 20 dB, transponder bandwidth 36 MHz, downlink frequency 4 GHz, total path loss -196.5 dB and other losses -3.7 dB, receiving antenna gain 49.7 dB, receiver IF bandwidth 27 MHz and noise temperature 75 K, calculate received power, noise power and C/N ratio of the link. If minimum C/N required is 12 dB then comment on whether the link will work successfully or not. 7
8. (a) What are the uplink design issues? Why uplink design is easier than downlink? 3
- (b) A satellite uplink in Ku-band has various parameters as follows: transponder noise temperature 500 K, transponder bandwidth 43.2 MHz, uplink frequency 14.15 GHz, total path loss -207.2 dB, antenna misalignment loss -3.0 dB and other losses -1.0 dB, transmitting antenna gain 55.7 dB, receiving antenna gain 60.0 dB and C/N requirement is 30 dB. Calculate uplink noise power and hence transmitter power requirement to achieve above C/N ratio of the link. 7
9. (a) What are short term and long term fading in satellite signal? 2
- (b) With the help of appropriate block diagrams, describe how frequency and space diversity techniques are useful in overcoming signal fading. 4
- (c) A satellite at a distance of 36000 km from earth surface radiates a power of 4 W from an antenna of gain 15 dB. Find the flux density and power received by an antenna of effective area 12 m<sup>2</sup>. If the receiving antenna has a gain of 50 dB, then also find the received power. 4
- 10 (a) What are the different modulation and multiplexing techniques used in satellite communication? 2
- (b) What is frequency modulation? Deduce an expression of S/N ratio for a baseband FM signal and hence estimate bandwidth enhancement. 6
- (c) In a FM system, the modulating signal has maximum frequency of 5.5MHz and modulated signal has deviation of 9 MHz, calculate bandwidth requirement of receiver. 2
- 11 (a) Why multiple access techniques are used in satellite communication? What are different such techniques? 2
- (b) From the analysis of FDMA system having 'n' number of earth stations with equal bandwidth of B Hz and fixed satellite bandwidth of B<sub>sat</sub>, find out an expression of satellite transmitted power P<sub>T</sub> and hence explain why an FDMA system is either power limited or bandwidth limited in terms of number of carriers that can access the satellite. 5
- (c) In an FDMA link the following data is available: (C/N)<sub>U</sub>=22dB, (C/N)<sub>D</sub>=25dB, (C/N)<sub>IM</sub>=22dB, (C/I)<sub>U</sub>=200dB, (C/I)<sub>D</sub>=175dB Calculate the overall CNR of the link. 3
12. Write short notes on any two of the following.
- (a) Equipment Reliability and Space Qualification 5
- (b) Satellite Antenna Systems 5
- (c) Effects on Orbit and Orbital Perturbation 5
- (d) Satellite Launching 5

-End-

**B. Tech Examination-2022**  
**Electronics and Communication Engineering**  
**(Odd Semester Regular and Supplementary)**

**Image Processing and Computer Vision/Digital Image Processing (Code: ECEUGPE07/ECE417)**

**Full Marks: 80**

**Time: 3 Hours**

Answer any 8 questions.

- i) Answers to the same question should be in contiguous pages.
- ii) Missing data, if any, may be assumed with justification.

- 1.a) Explain the 4, 8 and m connectivity of pixels with the help of an example. 3
- b) Given a grayscale image in tif with the following information: 3  
 File Size: 297030; Width: 600; Height: 494; Bit Depth: 8; XResolution: 105.5118; YResolution: 105.5118; Resolution Unit: 'Centimeter'. Find: (i) Physical width of image (ii) Physical height of image (iii) Compression ratio.
- c) Define Histogram equalization? Perform Histogram Equalization on the following  $8 \times 8$  image. 1+3  
 Draw the original histogram, Equalized histogram. The gray level distribution of the given image is given below:

Gray level ( $r_k$ )	0	1	2	3	4	5	6	7
No. of pixels ( $p_k$ )	8	10	10	2	12	16	4	2

- 2.a) What will be the output of input image shown below after median filtering? 2
- |   |   |   |
|---|---|---|
| 1 | 2 | 3 |
| 6 | 5 | 4 |
| 7 | 3 | 1 |
- b) Explain the basic steps of filtering in frequency domain with a block diagram. 3
- c) Describe how homomorphic filtering technique is used to separate illumination and reflectance component of a digital image? 5
- 3.a) Explain first order and second order derivative for following data. Discuss property and applications of both. 5

5	5	4	3	2	1	0	0	0	6	0	0	0	0	1	3	1	0	0	0	0	7	7	7	7
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

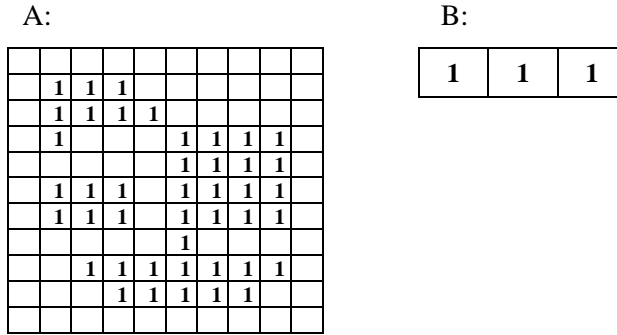
- b) What do you mean by unsharp masking? Discuss the steps to do unsharp masking. 2
- c) An image segment is shown below. Let, V be the set of gray level values used to define connectivity in the image. Compute D<sub>4</sub>, D<sub>8</sub> and D<sub>m</sub> distances between pixels 'p' and 'q' for : 3  
 (i)  $V = \{2,3\}$  (ii)  $V = \{2,6\}$

2 (p)	3	2	6	1
6	2	3	6	2
5	3	2	3	5
2	4	3	5	2
4	5	2	3	6 (q)

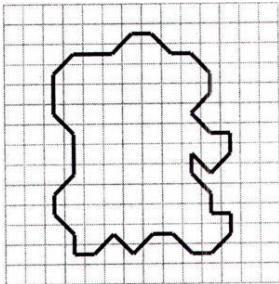
- 4.a) With neat diagram, explain the image degradation model. An input image  $g(x, y)$  is blurred by convolution by a blurring function  $h(x, y)$  and then has random noise  $n(x, y)$  added. Give a mathematical expression for the resulting image  $f(x, y)$ . 4+1
- b) Complete the following table with the most suitable restoration filters: 2

Noise →	Gaussian	Salt	Pepper	Salt-and-pepper	Gaussian & Salt-and-pepper
Filter					

- c) What are the different mean filters used for restoration? Explain any one with suitable example of application. 1+2
- 5.a) Define Erosion and Dilation processes with reference to digital image processing. 4
- b) You are given the binary image A and the structuring element B below (assume the origin of B is its center). Compute (by hand) the morphological erosion and dilation of A with B. 6



- 6.a) What are the basic qualities that are used to describe the quality of a chromatic light source? Define all. 3
- b) Explain RGB colour model of an image. 4
- c) Elucidate the step-by-step process to convert RGB to HSI model. 3
- 7.a) Describe the HSI color image model. Explain the colors conversion from HSI to RGB. 3+4
- b) Explain CMY model used in color image processing. 3
- 8.a) What is image segmentation? What are the basic approaches for segmenting an image? 1+2
- b) Explain briefly thresholding-based image segmentation techniques. 4
- c) Prove that the Laplacian operator is independent of rotation. 3
- 9.a) For an Object with the following boundary, obtain a rotation invariant chain code description. 5



- b) Discuss in brief Hit or Miss Transformation for object shape detection 5
- 10.a) Discuss in detail Opening and Closing which are important Morphological operations. 3+3
- b) Discuss principle of operation of adaptive filtering technique. 4
- 11. What is the goal of image Compression? Draw a functional block diagram of a general image compression system. Discuss compression process and de-compression process with this block diagram. 2+2+6

-End-

**B Tech Examination 2022**  
**Electronics and Communication Engineering**  
**(Odd Semester Regular and Supplementary)**  
**RF and Microwave Engineering (ECEUGPE10)**

Answer any eight questions.

Symbols have their usual meaning.

Full Marks: 80

Time: 3.00 Hr

- 1 a) Write down the boundary condition for dielectric interface, interface with a perfect conductor and interface with a magnetic wall. 2+2+2+4  
 b) What are the characteristics of a waveguide? 10
- 2 Calculate the field expressions ( $\mathbf{E}_\rho$ ,  $\mathbf{E}_\phi$ ,  $\mathbf{H}_\rho$ ,  $\mathbf{H}_\phi$ ) for TE mode in circular wave guide. 10
- 3 Find the cut-off frequencies of the first two propagating modes of a Teflon filled circular wave guide with  $a=0.5$  cm. If the interior of the guide is gold plated, 30 cm length operating at 14 GHz. Also calculate dielectric loss. [ Given :  $P'_{11} = 1.841$ ,  $P_{01} = 2.405$ ,  $\epsilon_r = 2.08$ ] 5+5
- 4 An air-filled 5-cm by 2-cm waveguide has  $E_z = 20 \sin 40\pi x \sin 50\pi y e^{-j\beta z}$  V/m at 15 GHz. (a) What mode is being propagated? (b) Find  $\beta$ . 5+5
- 5 Calculate the total power flow in rectangular waveguide for TM to Z mode. 10
- 6 a) A rectangular metal wave guide filled with a dielectric material of relative permittivity  $\epsilon_r = 4$  has the inside dimensions  $3.0 \text{ cm} \times 1.2 \text{ cm}$ . Calculate the cut-off frequency in dominant mode. 5+5  
 b) An air-filled rectangular waveguide has inner dimensions of  $3 \text{ cm} \times 2 \text{ cm}$ . Calculate the wave impedance of the  $\text{TE}_{20}$  mode of propagation in the waveguide at a frequency of 30 GHz is (free space impedance  $\eta_0 = 377 \Omega$  ).
- 7 Calculate the power dissipation in rectangular wave guide walls for  $\text{TE}_{01}$  Modes. 10
- 8 a) What are Transferred electron devices? 2  
 b) What is the need of negative resistance in microwave generation? 2  
 c) Mathematically explain the working principle of GUNN diode. 6
- 9 a) What is waveguide junction? 2  
 b) What types of waveguide junctions are available? Explain each type with construction, field line. 6  
 c) Explain waveguide E bend and H bend. 2
- 10 a) What is reflex klystron? Explain the working principle of reflex klystron with diagram. 5  
 b) Write down the application of reflex Klystron. 5
- 11 A rectangular waveguide with dimensions  $a = 2.5 \text{ cm}$ ,  $b = 1 \text{ cm}$  is to operate below 15.1 GHz. How many TE and TM modes can the waveguide transmit if the guide is filled with a medium characterized by  $\sigma = 0$ ,  $\epsilon = 4\epsilon_0$ ,  $\mu_r = 1$ . Calculate the cut off frequencies of the modes. 5+5
- 12 For a rectangular waveguide of internal dimensions  $a \times b$  ( $a > b$ ), the cut-off frequency for the  $\text{TE}_{11}$  mode is the arithmetic mean of the cut-off frequencies for  $\text{TE}_{10}$  mode and  $\text{TE}_{20}$  mode. If  $a = \sqrt{5} \text{ cm}$ . what is the the value of  $b$  (in cm) ? 10
- 13 Calculate the quality factor for rectangular cavity resonator for  $\text{TE}_{011}$  mode. 10

**Odd Semester Examination 2021-2022**  
**Paper Code: MBAUGHU01; Paper Name: Industrial Economics and Management**  
**Department of ECE**  
**Full Marks: 80**  
**Time: 3 Hours**

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*(The figures in the margin indicate full marks.  
Candidates are required to give their answers in their own words as far as possible)*

**GROUP: A (Answer *all* the questions) (1 x 10 = 10)**

1. I. Choices made by larger bodies like countries is called

- a) Microeconomics      b) Macroeconomics      c) National Economics      d) None of the above

II. The value of the next best alternative is called

- a) Opportunity cost      b) variable cost      c) marginal cost      d) fixed cost

III. When the price of the commodity increases the quantity demanded will

- a) increase      b) be indifferent      c) decrease      d) none of the above

IV. The satisfaction or happiness a person gets from consuming a good or service is called

- a) need      b) want      c) Opportunity cost      d) utility

V. GST is an example of .....

- a) direct tax      b) VAT      c) indirect tax      d) service tax

VI. According to Maslow's theory of hierarchical needs, food and shelter are part of ..... needs

- a) esteem      b) social      c) safety      d) physiological

VII. In selling, the focus is on the product, and in marketing, the focus is on

- a) price      b) customer's need      c) promotion      d) competition

VIII. According to ..... 3.4 defects only will be in one million opportunities

- a) Kaizen      b) TQM      c) Six Sigma      d) None of the above

IX. Sources of finance for business organization include

- a) equity      b) debt      c) bonds      d) all of the above

X. Job rotation is a form of.....methods

- a) On the job training      b) Off the job training      c) Mixed training      d) All of the above



**GROUP: A (Answer any Five questions)**  
**(Maximum word limit: 150 per answer)**

**(5 x 5 = 25)**

2. Describe the following concepts of Economics; scarcity, choice and opportunity cost.
3. a) What do you mean by resource in the context of Economics?  
b) Distinguish between need and want.
4. Elucidate utility, diminishing marginal utility and indifference curve.
5. Describe the factors of production.
6. Explain law of demand, supply and elasticity of demand.
7. Define inflation and explain its causes and types.
8. Brief about the tax system in India.

**GROUP: B (Answer any three questions)**  
**(Maximum word limit: 300 per answer)**

**(3 x 15 = 45)**

9. a) State any four functions of marketing management.  
b) Why is marketing management important in the context of present business environment?  
c) Write a note on 4 Ps of marketing.
10. Explain the different theories of motivation.
11. Discuss the importance of Human Resource Management and Financial Management.
12. Write short notes on Quality management and Production Management.
13. Explain the concept of Materials Management and Inventory Control Techniques.