Reg. No. : | | | | | | | | | | | | |

ECE

Question Paper Code : 70040

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Second Semester

Electronics and Communication Engineering

BE 3254 — ELECTRICAL AND INSTRUMENTATION ENGINEERING

(Common to Electronics and Telecommunication Engineering)

(Regulations – 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List the feature of an ideal transformer.
2. Draw the no load equivalent circuit of a transformer.
3. Why commutator employed in DC machines?
4. What is the need of a starter to start the DC motors?
5. Write the speed control method of three phase induction motor from stator side.
6. Name the starting methods of synchronous motor.
7. Define calibration and classify its methodologies.
8. Classify the types of instruments.
9. List the various voltage are used in distribution system.
10. Recall any four the electrical safety precautions.

PART B — (5 × 13 = 65 marks)

11. (a) Explain the construction and principle of operation of three phase transformer. (13)

Or

(b) What is autotransformer? Describe the working of step up and step down auto transformer. (13)

12. (a) Explain the construction details and principles of operation of a DC generator also derive its emf equation. (13)

Or

(b) (i) Draw and explain the various characteristics of DC shunt and series motors. Also write its applications based on their characteristics. (7)

(ii) Explain the principle of operation of stepper motor. (6)

13. (a) Describe the constructional details of squirrel cage and slip ring induction motors. Also discuss working principle of induction motor. (13)

Or

(b) Name the different types of single phase induction motor and explain its operating principle with the help of neat diagram. (13)

14. (a) Enumerate three phase power measurement by two wattmeter method for balance load star connected system with relevant diagram. (13)

Or

(b) With neat sketch describe the construction and working of an instrument transformer for measurement of current and voltage. (13)

15. (a) (i) Draw the power system structure and explain briefly. (5)

(ii) What is earthing and explain any one type of earthing. (8)

Or

(b) (i) Explain the construction details of ELCBs with necessary diagram. (8)

(ii) Discuss the operation of switch fuse unit. (5)

PART C — (1 × 15 = 15 marks)

16. (a) A 5 kVA, 500/250 V, single phase transformer gave the following readings,

O.C. Test : 500 V, 1A, 50 W (L.V. side open)

S.C. Test : 25 V, 10 A 60 W (L.V. side shorted)

Draw the equivalent circuit referred to primary and insert all the values in it.

Or

(b) A single phase transformer has 350 primary and 1050 secondary turns. The primary is connected to 400 V, 50 Hz a.c. supply. If the net cross sectional area of the core is 50 cm^2, calculate

(i) The maximum value of the flux density in the core

(ii) The induced e.m.f. in the secondary windings. (15)

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Question Paper Code : 70082

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Second Semester

Electronics and Communication Engineering

EC 3251 – CIRCUIT ANALYSIS

(Common to: Electronics and Telecommunication Engineering)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Summarize the basic mesh analysis procedure.

2. State Ohm's law and its limitations.

3. Three resistors $10\Omega, 5\Omega$ and 20Ω are connected in star. What are the equivalent delta resistors?

4. Define dual networks. List out four pairs of dual quantities.

5. What is admittance? What are its components?

6. Give the relation between apparent power, average power and relative power.

7. An RLC series circuit has $R = 10\Omega, XC = 62.833\Omega$. Find the value of L for resonance at 50HZ.

8. Write the characteristics of series resonance.

9. Define mutual inductance and write an expression for it.

10. State the dot rule for coupled circuit.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Define the terms Nodes, Branches, Loops and Meshes. (5)

(ii) Find the number nodes, branches, loops and meshes present in the given circuit. (8)

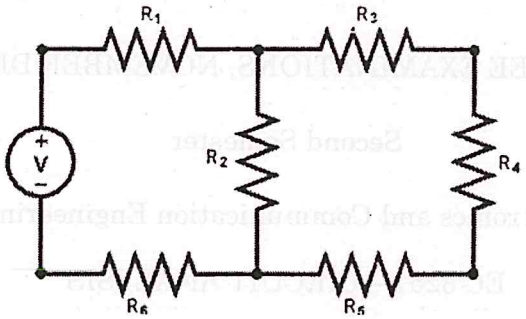

Fig. Q. 11 (a)

Or

(b) (i) State and Explain Kirchhoff's laws. (10)

(ii) List the difference between series and parallel circuits. (3)

12. (a) Determine the current I in the network by using Thevenin's theorem. (13)

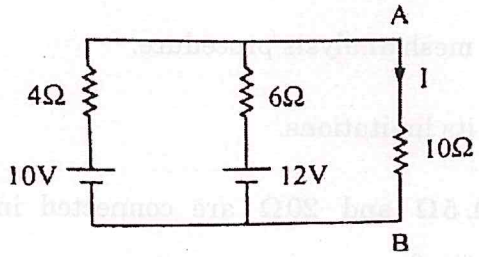

Fig. Q. 12 (a)

Or

(b) Find the current through 23 Ω resistor of the given circuit using superposition theorem. (13)

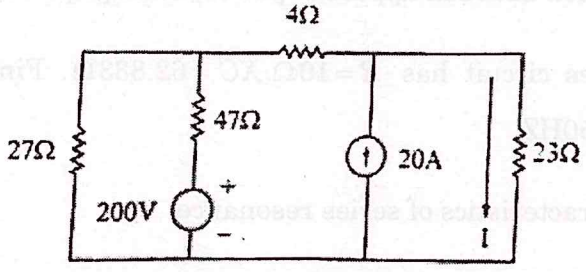

Fig. Q. 12 (b)

13. (a) In a RLC series circuit, the applied voltage is 5V. Drops across the resistance and inductance are 3V and 1V respectively. Calculate the voltage across the capacitor. Draw the phasor diagram. (13)

Or

(b) Use nodal voltage method to find the power dissipated in the 10Ω resistor on the circuit shown in the figure. Q. 13 (b) (13)

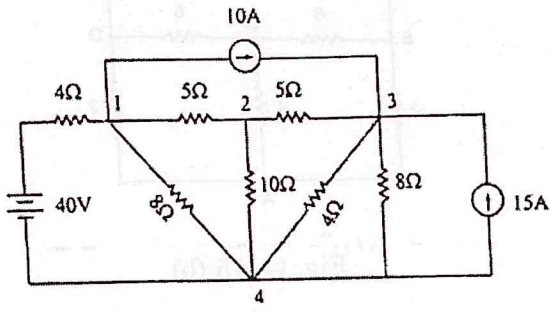

Fig. Q. 13 (b)

14. (a) A series RLC circuit has R =50Ω, L = 0.2H and C =50 μF. Constant voltage of 100V is impressed upon the circuit at t = 0. Find the expression for the transient current assuming initially relaxed conditions. (13)

Or

(b) For the circuit shown, determine the currents i_1 and i_2 when the switch is closed at t =0. Assume that the initial current through the inductor is 0. (13)

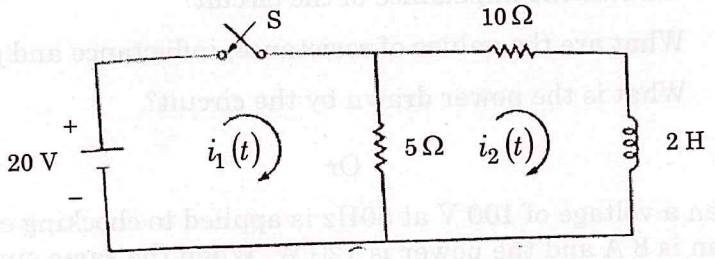

Fig. Q. 14 (b)

15. (a) For the given coupled circuit, find the voltage across the 5 Ω resistor. (13)

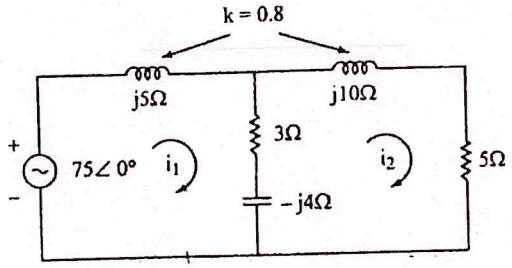

Fig. Q. 15 (a)

Or

(b) For the network given, draw the graph and a tree. Show the link currents. Write the tie-set schedule for the tree, the equations for branch currents in terms of link currents. Also write independent equations. (13)

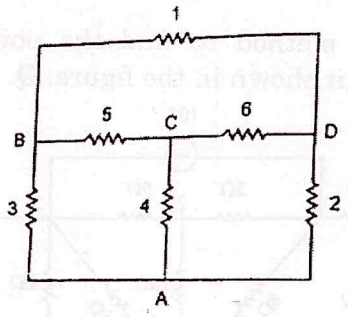

Fig. Q. 15 (b)

PART C — (1 × 15 = 15 marks)

16. (a) A series circuit containing pure resistance and pure inductance the current and voltages are $i(t)=5\sin\left(314+\frac{2\pi}{3}\right)$ and $v(t)=20\sin\left(314+\frac{5\pi}{6}\right)$

(i) What is the impedance of the circuit?

(ii) What are the values of resistance, inductance and power factor?

(iii) What is the power drawn by the circuit?

Or

(b) When a voltage of 100 V at 50Hz is applied to chocking coil 1, the current taken is 8 A and the power is 120 W. When the same supply is applied to chocking coil 2, the current is 10 A and the power is 500 W. Find the current and power when the supply is applied to two coils connected in series.

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Question Paper Code : 70183

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Second Semester

Electronics and Communication Engineering

PH 3254 — PHYSICS FOR ELECTRONICS ENGINEERING

(Common to Electronics and Telecommunication Engineering)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define unit cell.

2. Find the maximum radius of the interstitial sphere that can fit into the void at (1/2, ½, ½) between the atoms in the BCC structure.

3. Calculate Lorentz number for copper at 293 K, if the electrical conductivity and thermal conductivity are $1.72\times10^{-8}\Omega m$ and 386 W/mK respectively.

4. Define Fermi surface or Fermi sphere.

5. How are holes generated in p- type semiconductors?

6. The intrinsic carrier density at room temperature in Ge is $2.37 \times 10^{19}/m^3$. If the electron and hole mobilities are 0.38 and 0.18 m^2/Vs respectively, calculate the resistivity.

7. Differentiate the optical absorption process that occur between direct and indirect bandgap semiconductors.

8. Give any two points that differentiate laser diode and LED.

9. Draw the density of states for bulk and quantum well structures.

10. Is energy band gap of nanomaterial greater than its bulk counterpart? If so give reason.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Calculate the packing factors of SC and FCC with neat diagram. (4+6 =10)

(ii) Mention any five crystal systems, their unit vectors and angles in tabular form. (6)

Or

(b) (i) Discuss briefly the point and line imperfections in crystal with neat diagram. (10)

(ii) Calculate the equilibrium concentrations of point imperfections at 300 K in the case of copper. The enthalpy of formation of point imperfections is 120KJ/mol. Gas Constant = 8.314 kJ/molK. (6)

12. (a) (i) Derive the expression for density of energy states for solids and find the carrier concentration at any temperature. (10)

(ii) Using the expression of Fermi-Dirac distribution function, find the probability of finding the electron at

(i) T = 0K and $E<E_f$

(ii) T = 0K and $E = E_f$ (6)

Or

(b) (i) Briefly discuss paramagnetism and ferromagnetism, in magnetic materials and their properties. (10)

(ii) A paramagnetic material has a magnetic field intensity of 10^4 A/m. If the susceptibility of the material at room temperature is 3.7×10^{-3}, calculate magnetization and flux density in the material. (6)

13. (a) (i) Derive the expression for carrier concentration in intrinsic semiconductors. (10)

(ii) For an intrinsic semiconductor with gap width $E_g = 0.7eV$, calculate the concentration of intrinsic charge carriers at 300 K assuming that $m^*e = m^*h = m_0$ (rest mass of electron). (6)

Or

(b) (i) Describe the variation of carrier concentration with temperature in n -type semiconductor with diagram. (10)

(ii) Suppose that the effective mass of holes in a material is 4 times that of electrons. At what temperature would Fermi level be shifted by 10% from the middle of the forbidden energy gap? Given $E_g = 1eV$. (6)

14. (a) Explain briefly with expression for optical absorption and emission processes in the direct and indirect band gap semiconductor. (16)

Or

(b) Describe briefly the working principle, energy bands and spectral characteristic of double heterojunction laser diode with neat diagram. (16)

15. (a) Explain briefly the density of states for quantum well and quantum wire. In which way is it superior to bulk materials? (16)

Or

(b) Explain briefly the operation of single electron transistor using single electron phenomenon with neat diagram. (16)

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Question Paper Code : 70087

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Third Semester

Electronics and Communication Engineering

EC 3354 — SIGNALS AND SYSTEMS

(Common to: Computer and Communication Engineering/Electronics and Telecommunication Engineering/Medical Electronics)

(Regulations 2021)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State whether the following system y (t) = 2t × (t) is time variant or not.

2. Differentiate between causal and non-causal systems.

3. Define Fourier transform.

4. If $X(s)=\frac{2}{(s+3)}$. Find the Laplace transform of $\frac{dx(t)}{dt}$.

5. Determine the impulse response h (t) of the following system $y(t)=x(t-t_o)$. Assume zero initial conditions.

6. Perform Convolution of the causal signal $x_1(t)=2u(t)$, $x_2(t)=u(t)$ using Laplace transform.

7. Compare Fourier transform of discrete and continuous time signals.

8. State the Linearity property of Z transform.

9. What is a recursive system?

10. In an LTI System the impulse response, $h(n)=C^n$ for n ≤ 0. Determine the range of values of C, for which the system is stable.

PART B — (5 × 13 = 65 marks)

11. (a) Determine the periodicity of the following continuous time signals.

(i) $x(t) = 2 \cos 3t + 3 \sin 7t$ (6)

(ii) $x(t) = 5 \cos 4\pi t + 3 \sin 8\pi t$ (7)

Or

(b) Test whether the system $d^2y(t) / dt^2 + 2\, dy(t)/dt + 3\, y(t) = x(t)$ is linear or not.

12. (a) Derive the fourier transform expression from the exponential form of fourier series.

Or

(b) State and prove initial value theorem and final value theorem using Laplace Transform.

13. (a) Explain the cascade structure and parallel structure of continuous time systems with neat diagram.

Or

(b) Perform convolution of $x_1(t) = e^{-2t} \cos 3t\, u(t)$ and $x_2(t) = 4 \sin 3t\, u(t)$ using Laplace transform.

14. (a) Explain the Correlation property and Parseval's relation in DTFT.

Or

(b) Find the one sided z transform of the discrete time signals generated by mathematically sampling the following continuous time signal $x(t) = e^{-at} \cos \Omega_0 t$.

15. (a) Find the transfer function and unit sample response of the second order difference equation with zero initial conditions $y(n) = x(n) - 0.25y(n-2)$

Or

(b) Find the linear convolution of the sequence, $x(n) = \{-1, 1, \underset{\uparrow}{2}, -2\}$ and $h(n) = \{0.5, 1, \underset{\uparrow}{-1}, 2, 0.75\}$

PART C — (1 × 15 = 15 marks)

16. (a) Using z transform, perform deconvolution of the response, $y(n) = \{1, 4, 8, 8, 3, -2, -1\}$ and impulse response h(n) = {1, 2, 1, -1} to extract the input x(n).

Or

(b) Evaluate the step response of an LTI system whose impulse response, is given by $h(n) = a^{-n}\, u(-n);\ 0 < a < 1$.

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Question Paper Code : 70084

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Third Semester

Electronics and Communication Engineering

EC 3351 – CONTROL SYSTEMS

(Common to: Electronics and Telecommunication Engineering)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define the transfer function of the system.

2. Write the analogous electrical elements in force voltage analogy for the elements of mechanical translational system.

3. Define order of the system.

4. Mention the effect of PD controller on system performance.

5. What are the Frequency domain specifications?

6. For a stable system the gain margin and phase margin should be positive. Justify your answer.

7. What do you mean by relative stability?

8. State Routh's criterion for stability.

9. What is state transition matrix?

10. Write the advantages of state space modeling?

PART B — (5 × 13 = 65 marks)

11. (a) Determine the transfer function, $\frac{X_1(S)}{F(S)}$ and $\frac{X_2(S)}{F(S)}$ for the system shown in following fig Q.11(a).

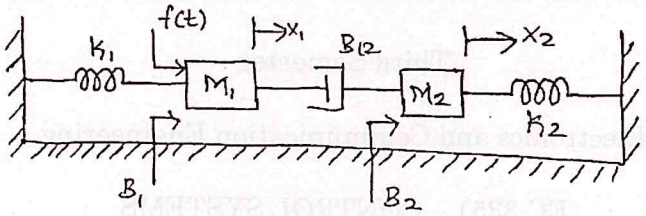

Fig Q 11(a)

Or

(b) (i) By using block diagram reduction technique find, $\frac{C(S)}{R(S)}$.

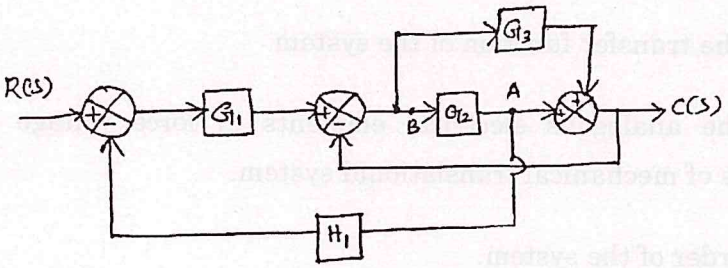

Fig Q 11(b) (i)

(ii) Find the T.F. for the following SFG using Mason's gain formula.

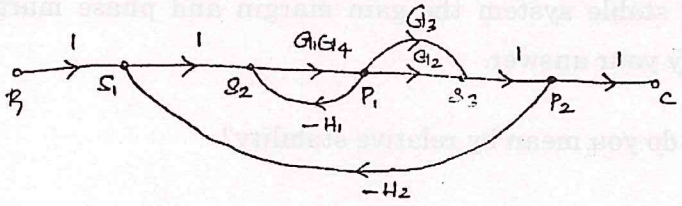

Fig 11(b) (ii)

12. (a) The unity feedback system is characterised by an open loop transfer function, $G(S)=\frac{K}{s(s+10)}$. Determine the gain K, so that the system will have a damping ratio of 0.5 this value of K. Determine settling time, peak overshoot and time at peak overshoot for a unit step input.

Or

(b) The open loop transfer of a feedback control system with unity feedback is given by, $G(S)=\frac{40}{s(1+0.5\,s)}$. Determining the error constants for the system. Also obtain the steady state error when the input is $r(t)=1+5t+5t^2$.

13. (a) Draw the Bode plot for the open loop transfer function, $G(S)\,H(S)=\frac{20s^2}{(1+0.2s)(1+0.02\,s)}$ and determine the gain cross over frequency and phase cross over frequency of the system.

Or

(b) Draw the electrical equivalent circuit of Lag compensator and obtain its transfer function. Also, explain the design procedure of lag compensator.

14. (a) The open loop transfer function of a unity feedback system is given by, $G(S)=\frac{k(s+3)}{s(s+2)(s+7)}$. Find the range of a K for stable system.

Or

(b) The open loop transfer function of a unity feedback system is given by, $G(S)=\frac{K(s+9)}{s(s^2+4s+11)}$ Sketch the root locus of the system.

15. (a) Obtain state space representation for system, $y''+3y'+2y=0$. Also find the state transition matrix $\varphi(t)$.

Or

(b) Check the controllability and observability for the system described by,

$$x=\begin{bmatrix}0 & 6 & -5\\ 1 & 0 & 2\\ 3 & 2 & 4\end{bmatrix}x+\begin{bmatrix}0\\1\\2\end{bmatrix}u \quad y=\begin{bmatrix}1 & 2 & 2\end{bmatrix}x.$$

PART C — (1 × 15 = 15 marks)

16. (a) Sketch the polar plot for the given unity feedback system having an open loop transfer function $G(S)=\frac{k}{s(1+0.2s)(1+0.1s)}$ and also determine K so that phase margin is 60°.

Or

(b) Explain the significance of controller and mention its types and also the design procedure for PID controller in feedback control system.

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Question Paper Code : 70086

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Third Semester

Electronics and Communication Engineering

EC 3353 – ELECTRONIC DEVICES AND CIRCUITS

(Common to: Electronics and Telecommunication Engineering)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Draw the symbol of the following devices PN Diode, Zener Diode, LED and UJT.

2. A full-wave rectifier uses two diodes, the internal resistance of each diode may be assumed constant at 20 Ω. The transformer R.M.S. secondary voltage from Centre tap to each end of secondary is 50 V and load resistance is 980 Ω. Evaluate :

   (a) The mean load current

   (b) The R.M.S. value of load current

3. An amplifier operating from $\pm 3V$ provide a 2.2V peak sine wave across a 100 ohm load when provided with a 0.2V peak sine wave as an input from which 1.0mA current is drawn. The average current in each supply is measured to be 20mA. What is the amplifier efficiency?

4. Define current amplification factor.

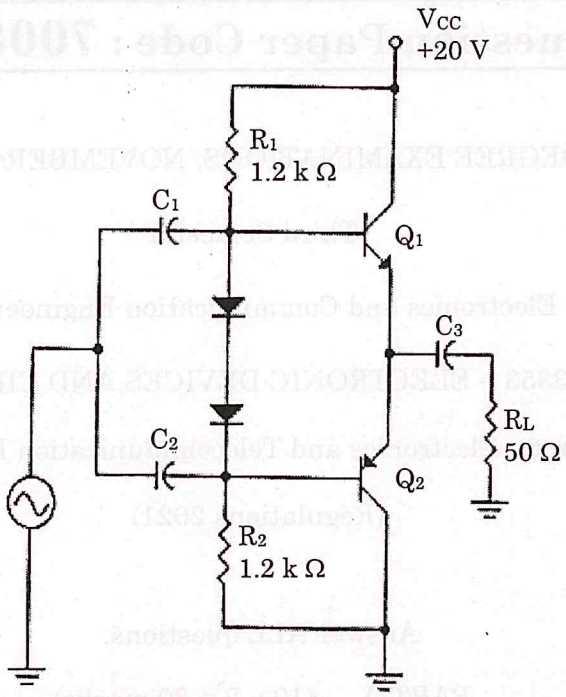
5. Define CMRR. Give its ideal value.

6. Which type of connection is made for cascode amplifier?

7. What is feedback amplifier and give its types?

8. State Barkhausen criterion for sustained oscillation. What will happen to the oscillation if the magnitude of the loop gain is greater than unity?

9. Calculate VB2.



10. What is DC-DC bidirectional converter?

PART B — (5 × 13 = 65 marks)

11. (a) Describe the Unijunction Transistors', working theory and ways in which they differ from BJTs.

Or

(b) How is Zener diode used as voltage regulator? Explain the working principle of Zener voltage regulator.

12. (a) Derive the equations for voltage gain, current gain, input impedance and output admittance for a BJT using low frequency h-parameter model for (i) CE configuration (ii) CB configuration and (iii) CC configuration.

Or

(b) (i) Give the MOSFET small signal model. (6)

(ii) Analyse Common Source Amplifier for finding voltage gain, Input and output Impedance. (7)

13. (a) An amplifier rated at 40W output is connected to a 10Ω speaker.

(i) Calculate the input power required for full power output if the power gain is 25 db. (7)

(ii) Calculate the input voltage for rated output if the amplifier voltage gain is 40 db. (6)

Or

(b) What is differential amplifier and explain the operation in common mode and differential mode.

14. (a) Classify the feedback amplifiers and explain. What will happen to gain, input impedance, output impedance, and bandwidth for an amplifier with current series feedback.

Or

(b) Explain pierce crystal oscillator and derive the equation for oscillation.

15. (a) In an amplifier, the output power is 1.5 watts at 2 kHz and 0.3 watt at 20 Hz, while the input power is constant at 10 mW. Calculate by how many decibels gain at 20 Hz is below that at 2 kHz?

Or

(b) What is boost converter and buck converter? How does a buck-boost circuit work?

PART C — (1 × 15 = 15 marks)

16. (a) What type of feedback is required in transistor to behave as an oscillator? Describe the working of Heartley Oscillator in detail. Find the expression for frequency of oscillator.

Or

(b) Give the circuit of an RC coupled transistor amplifier. Explain the frequency Response characteristics curve of RC coupled amplifier. State the reason for the shape of the curve.

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Question Paper Code : 70142

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Third Semester

Electronics and Telecommunication Engineering

MA 3355 – RANDOM PROCESSES AND LINEAR ALGEBRA

(Common to: B.E. Electronics and Communication Engineering)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Using the axioms of probability, prove $P(A^c) = 1 - P(A)$.

2. Consider a random experiment of tossing a fair coin three times. If X denotes the number heads obtained find, $P(X < 2)$.

3. For a bi-variate random variable (XY), prove that if X and Y are independent, then every event $a < X \leq b$ is independent of the other event $c < X \leq d$.

4. Let the joint probability mass function of (X, Y) be given by $P_{xy}(x, y) = \begin{cases} k(x+y) & x = 1,2,3; y = 1.2 \\ 0, & otherwise \end{cases}$. Find the value of k.

5. Let $X_1, X_2 \ldots$ be independent Bernoulli random variables with $P(X_n = 1) = p$ and $P(X_n = 0) = q$ for all n. Describe the Bernoulli process.

6. Consider a Markov chain with two states and transition probability matrix $P = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$. Find the stationary distribution of the chain.

7. Determine whether the vectors $u = (1,1,2), v = (1,0,1)$, and $w = (2,1,3)$ span the vector space R^3.

8. Is a set of all vectors of the form $(a,1,1)$, where a is real, a subspace of R^3? Justify.

9. Find the kernel and range of the identity operator.

10. Show that the vectors $u = (-2, 3, 1, 4)$ and $v = (1, 2, 0, -1)$ are orthogonal in R^4.

PART B — (5 × 16 = 80 marks)

11. (a) (i) A lot of 100 semiconductor chips contain 20 that are defective. Two are selected randomly, without replacement, from the lot.

(1) What is the probability that the first one selected is defective?

(2) What is the probability that the second one selected is defective given that the first one was defective?

(3) What is the probability that both are defective? (8)

(ii) A company producing electric relays has three manufacturing plants producing 50, 30, and 20 percent respectively of its product. Suppose that the probabilities that a relay manufactured by these plants is defective are 0.02, 0.05 and 0.01 respectively. If a relay selected at random is found to be defective, what is the probability that it was manufactured by plant 2? (8)

Or

(b) (i) All manufactured devices and machines fail to work sooner or later. Suppose that the failure rate is constant and the time to failure (in hours) is an exponential random variable X with parameter λ. Measurements shows that the probability that the time to failure for computer memory chips in a given class exceeds 10^4 hours is e^{-1}. Find the value of λ and calculate the time X_0 such that the probability that the time to failure is less than X_0 is 0.05. (8)

(ii) A production line manufactures 1000 ohm resistors that have 10% tolerance. Let X denotes the resistance of a resistor. Assuming that X is a normal random variable with mean 1000 and variance 2500, find the probability that a resistor picked at random will be rejected. (8)

12. (a) Consider an experiment of drawing randomly three balls from an urn containing two red, three white, and four blue balls. Let (X, Y) be a bi-variate random variable where X and Y denote respectively the number of red and white balls chosen.

(i) Find the range of (X, Y).

(ii) Find the joint probability mass function of (X,Y).

(iii) Find the marginal probability function of X and Y.

(iv) Are X and Y independent? (16)

Or

(b) Test two integrated circuits one after the other. On each test, the possible outcomes are a (accept) and r (reject). Assume that all circuits are acceptable with probability 0.9 and that the outcomes of successive tests are independent. Count the number of acceptable circuits X and count the number of successful tests Y before you observe the first reject. (If both tests are successful, let $Y = 2$.)

(i) Find the joint probability mass function of X and Y.

(ii) Find the correlation between X and Y.

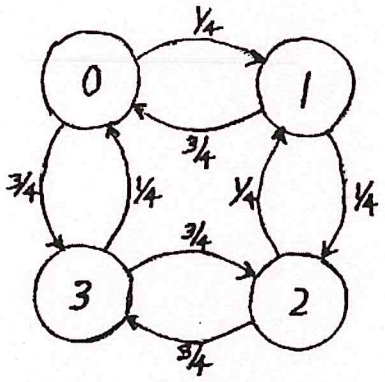
(iii) Find the covariance of X and Y. (16)

13. (a) (i) The input to a digital filter is an identical and independently distributed random sequence $\ldots, X_{-1}, X_0, X_1, \ldots$ with $E[X_i] = 0$ and $Var[X_i] = 1$. The output is a random sequence $\ldots, Y_{-1}, Y_0, Y_1, \ldots$ related to the input sequence by the formula $Y_n = X_n + X_{n-1}$ for all integers n. Find the expected value $E[Y_n]$ and auto-covariance function $C_Y[m, k]$. (8)

(ii) At the receiver of an AM radio, the received signal contains a cosine carrier signal at the carrier frequency fc with a random phase that is a sample value of the uniform $(0, 2\pi)$ random variable. The received carrier signal is $X(t) = A.\cos(2\pi f_c t + \theta)$. What are the expected value and autocorrelation of the process $X(t)$? (8)

Or

(b) Consider the Markov chain shown in the following figure.



(i) What is the period d of state 0?

(ii) What are the stationary probabilities π_0, π_1, π_2 and π_3?

(iii) Given the system is in state 0 at time 0, what is the probability the system is in state 0 at time nd in the limit as $n \to \infty$? (16)

14. (a) Determine whether the set of all pairs of real numbers (x, y) with the operations $(x, y) + (p, q) = (x + p + 1, y + q + 1)$ and $k(x, y) = (kx, ky)$ is a vector space or not. If not, list all the axioms that fail to hold. (16)

Or

(b) Determine the basis and the dimension of the homogeneous system $2x_1 + 2x_2 - x_3 + x_5 = 0$; $-x_1 - x_2 + 2x_3 - 3x_4 + x_5 = 0$; $x_1 + x_2 - 2x_3 - x_5 = 0$ $x_3 + x_4 + x_5 = 0$. (16)

15. (a) (i) State and prove the dimension theorem for linear transformation. (8)

(ii) Let $T : R^2 \to R^3$ be a linear transformation defined by $T\begin{pmatrix} x \\ y \end{pmatrix} = \begin{bmatrix} y \\ -5x + 13y \\ -7x + 16y \end{bmatrix}$. Find the matrix for the transformation T with respect to the bases $B = \{u_1, u_2\}$ for R^2 and $B_1 = \{v_1, v_2, v_3\}$ for R^3 where $u_1 = \begin{bmatrix} 3 \\ 1 \end{bmatrix}, u_2 = \begin{bmatrix} 5 \\ 2 \end{bmatrix}, v_1 = \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}, v_2 = \begin{bmatrix} -1 \\ 2 \\ 2 \end{bmatrix}, v_3 = \begin{bmatrix} 0 \\ 1 \\ 2 \end{bmatrix}$. (8)

Or

(b) Find the orthogonal projection of the vector $u = (-3, -3, 8, 9)$ on the subspace of R^4 spanned by the vectors $v_1 = (3, 1, 0, 1), v_2 = (1, 2, 1, 1)$, $v_3 = (-1, 0, 2, -1)$. (16)

Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 70085

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Third Semester

Electronics and Communication Engineering

EC 3352 — DIGITAL SYSTEMS DESIGN

(Common to: Electronics and Telecommunication Engineering)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Find the octal equivalent for the given decimal number $(149)_{10}$.

2. Simplify the Boolean function xy+x′z+yz to a minimum number of literals.

3. What is meant by combinational circuits? Give examples.

4. What is a parity bit?

5. Find the minimum number of flip flops required to build a modulo N counter.

6. Draw the master slave configuration using D-flip flop.

7. Differentiate between critical and non-critical race in asynchronous sequential circuits.

8. What is meant by fundamental mode sequential circuit?

9. Define fan in and fan out of a gate?

10. Write the difference between EPROM and EEPROM.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Simplify the four variable boolean function F(A,B,C,D) = Σ(0,2,3,5,7,8,9,10,11,13,15) and find the prime implicants and essential prime implicants. (8)

(ii) Express the Boolean function F=xy+x′z as a product of maxterms. (5)

Or

(b) Minimize the expression Y(A,B,C,D)=Σm(0,1,3,7,8,9,11,15) using tabulation method.

12. (a) (i) Explain the working of 3-bit even parity generator and checker. (7)

(ii) Illustrate the operation of priority encoder. (6)

Or

(b) (i) Design a full adder and implement in sum-of-product form. (7)

(ii) Construct the 4 × 16 decoder with two 3 × 8 decoders. (6)

13. (a) Elucidate the analysis and design of clocked sequential circuits with a suitable example.

Or

(b) List out the capabilities of a universal shift register. Illustrate the four bit universal shift register with a function table and explain its working.

14. (a) Mention the types of hazard that occur in combinational circuits? Demonstrate the occurrence of static 0-hazard with a suitable example and find the solution to fix the static hazard in combinational circuits.

Or

(b) Taking relevant examples, explain the various types of races that occur in sequential circuits. Also briefly explain about the race free state assignment.

15. (a) Design the following sum-of-minterms using PAL.

$W(A,B,C,D)=\Sigma(2, 12, 13)$

$X(A,B,C,D)=\Sigma(7,8,9,10,11,12,13,14,15)$

$Y(A,B,C,D)=\Sigma(0,2,3,4,5,6,7,8,10,11,15)$

$Z(A,B,C,D)=\Sigma(1,2,8,12,13)$

Or

(b) (i) Draw and explain the totempole TTL output configuration. (6)

(ii) Compare the characteristics of RTL, TTL, ECL and CMOS logic families. (7)

PART C — ($1 \times 15 = 15$ marks)

16. (a) Design a counter using JK flip flops with the following binary sequence: 1, 2, 5, 7 and repeat.

Or

(b) Design the binary to gray code converter and draw the simplified logic diagram in sum-of-product form.

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Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 90476

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Third / Fourth Semester

EC 8491 — COMMUNICATION THEORY

(Common to : Computer and Communication Engineering / Electronics and Communication Engineering / Geinformatics Engineering)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is meant by modulation index of Amplitude modulation?

2. Determine the Hilbert transform of the signal $x(t) = \sin(300\pi t)$.

3. What is meant by FM to AM conversion?

4. The power requirement of FM signal is independent of modulation index. Justify the statement.

5. What is meant by wide sense stationary Process?

6. Determine the mean and variance of random variable $z = x + y$, where x and y are independent random variables with mean values of 3 and 5 and variance values of 15 and 45 respectively.

7. What is need for pre emphasis in FM systems?

8. Calculate the noise figure of an amplifier if its input SNR is 10 dB and output SNR is 3 dB.

9. State the condition to avoid aliasing in sampling.

10. Distinguish non uniform quantization from uniform quantization.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Explain the phase shift method of generation of SSB signal. (7)

(ii) Consider that a message signal $m(t) = 2\cos(200\pi t) + \sin(300\pi t)$, modulates the amplitude of the carrier signal $c(t) = 2\cos(10000\ \pi t)$ with modulation index of 0.6,

(1) Write down the time and frequency domain expression for the modulated signal

(2) Determine the plot the spectrum of message and modulated signal. (3 + 3)

Or

(b) (i) Explain the working of ring modulator used to generate DSBSC signal in detail. (7)

(ii) Consider that a diode detector is used to demodulate the AM signal with carrier frequency of 1 MHz, message with highest frequency of 5 kHz. Design the circuit for the proper demodulation of signal with justification. (6)

12. (a) Derive the expression for the FM signal with arbitrary modulation index. Draw the spectrum of the signal. (9 + 4)

Or

(b) Explain the concept of FM demodulation using balanced frequency discriminator in detail. (13)

13. (a) (i) Let random variables X and Y be defined as $X = A\cos(\omega t + \Theta)$ and $Y = B\sin(\omega t + \Theta)$ where, A and ω are constants, the Θ is a random variable uniformly distributed over $[-\pi, \pi]$. Determine, Autocorrelation function $R_{XX}(\tau)$ and Cross correlation function $R_{XY}(\tau)$. (8)

(ii) State and explain the properties of power spectral densities of random process $X(t)$. (5)

Or

(b) (i) Let $X(t)$ is a random process with a constant mean value of 2 and the auto-correlation function $R_X(T) = 4\left(e^{-0.5|t|} + 1\right)$. Derive the power spectral density. (5)

(ii) A WSS process, $X(t)$ with mean μ_X and variance σ_x^2 is applied as input to linear time invariant filter. The output process obtained is $Y(t)$. Obtain the relationship between the statistical parameters of input and output processes. (8)

14. (a) Derive the figure of merit of AM receiver. (13)

Or

(b) Derive the Figure of merit of SSB SC receiver using the receiver system. (13)

15. (a) With neat block diagram illustrate the function of Differential pulse code modulation and also explain how it is made adaptive. (13)

Or

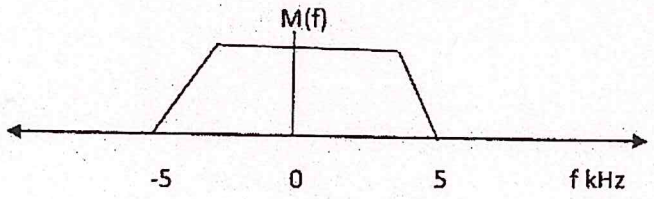
(b) Draw the block diagram of Delta Modulator. Explain its operation and also discuss the need for making DM adaptive. (5 + 8)

PART C — (1 × 15 = 15 marks)

16. (a) (i) A DSBSC signal $s(t)$ is generated by modulating the sinusoidal carrier signal of frequency $fc = 20\ MHz$ by the message signal $m(t)$ with spectrum $M(f)$ given in figure below. The modulated signal $s(t) = 10\, m(t) \cos 2\pi f ct$ is fed to a 50 Ω load. Draw the schematic of modulator.

(1) Determine the bandwidth and power requirements of the modulated signal.

(2) Draw the spectrum of carrier and modulated signal. (Refer Figure 1)



(3 + 4)

Figure 1

(ii) The modulated signal of part (i) is received by a receiver. The received signal need to be converted to 455 kHz before demodulation. Draw the neat block diagram of appropriate receiver and give the specifications of each block so that image frequency rejection is achieved. (8)

Or

(b) With suitable diagram and equations explain the transmission of a random process through a LTI filter. (15)

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Question Paper Code : 90475

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022

Fourth Semester

Electronics and Communication Engineering

EC 8453 – LINEAR INTEGRATED CIRCUITS

(Common to : Biomedical Engineering/Medical Electronics/Robotics and Automation)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define the need for Differential Amplifier compared to conventional Amplifier.

2. Why Active load is preferred compared to passive load in any Amplifier.

3. Draw the circuit to get the mentioned output using op-amp, $V_0 = -(0.2V_1 + 0.1V_2 + 10V_3)$.

4. If $V_{in} = 5V, R = 10k\Omega$ in a $V-I$ converter, Draw suitable circuit and find gain, I_L of op-amp circuit in non-inverting mode assume potential at non-inverting input is I, what is the output voltage?

5. Draw the pin diagram of AD 633 and list out alteast six Applications of Multiplier IC_s.

6. State the importance of Active filter in a PLL with neat sketches.

7. State various Applications of most commonly used ADC's.

8. The maximum frequency of input sine ware is 100 Hz and the conversion time is 10 μs (microsecond) for digitization. Determine Resolution of data converter.

9. What are linear voltage regulators and mention its limitations?

10. List the two modes of operation of 555 Ic timer.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Discuss the AC characteristics of an op-amp with suitable illustration, Explain Dominant pole compensation technique. (8)

(ii) Briefly explain the transfer characteristics of a differential pair with passive load. (5)

Or

(b) (i) With neat sketches, explain the block schematic of an op-amp IC 741. (8)

(ii) A 741 op-amp is used as an inverting Amplifier with a closed loop gain of 50. Find the maximum input signal that can be applied to get undistorted output if frequency response is constant upto 20 kHz? (5)

12. (a) (i) With neat diagram, Demonstrate the operation of a practical Integrator and derive an expression for gain. Plot the frequency Response. (8)

(ii) Discuss the Applications of V-I converter? (5)

Or

(b) (i) Explain the principle and operation of a Schmitt Trigger circuit with Transfer Characteristics? (8)

(ii) Design a wide band pass filter having $f_L = 400Hz$, $f_H = 2kHz$ and band pass gain of 4 find the Quality factor of the filter. (5)

13. (a) (i) Derive ΔI in terms of input voltages and emitter current I_{EE} and show that Gilbert cell can be used as Analog Multiplier. (8)

(ii) Explain the operation of a digital phase detector with relevant sketches. (5)

Or

(b) (i) With neat Block diagram, Explain the frequency multiplication and AM Detection using PLL? (8)

(ii) Design a four Quadrant analog multiplier using emitter coupled pair. (5)

14. (a) (i) Explain the operation of a Voltage Mode R – 2R DAC with suitable example. (8)

(ii) With neat sketches, Explain the operation of sample and hold circuit. (5)

Or

(b) (i) Explain the principle and operation of a 3-bit flash ADC with neat sketches. (8)

(ii) Discuss the need for sigma-delta converters and how it is better that other converters in terms of Resolution? (5)

15. (a) (i) Explain the principle and operation of a Wein bridge Oscillator with neat sketches? (8)

(ii) With neat sketches Explain the functional block diagram of 723 Regulator? (5)

Or

(b) (i) Explain the functional Block diagram of MF 10 state variable IC with neat sketches. (8)

(ii) Write a note on the following, Video Amplifier and Opto couplers. (5)

PART C — (1 × 15 = 15 marks)

16. (a) (i) Design an astable multivibrator using 555 IC with Duty cycle 75% and $fo=50kHz$, assume $C=1\mu F$? (10)

(ii) Design a Differentiator that will Differentiate an input signal with $f_{max}=100Hz$, assume $C_1=0.1\mu F$. (5)

Or

(b) (i) Design a 3-Bit SAR type ADC with $V_{in}=6.5V$ tabulate the conversion process to show digital output? (8)

(ii) A VCO has a free Running frequency of $21KHz/v$ and input signal frequency $f_s=20kHz, K_v=4kHz/v$. Find the change in the dc control voltage V_C during the lock time? (7)

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Question Paper Code : 90474

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Fourth Semester

Electronics and Communication Engineering

EC 8452 — ELECTRONIC CIRCUITS – II

(Common to Electronics and Telecommunication Engineering)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Though the circuit gain is less in negative feedback amplifiers, why is it preferred in many electronic circuits?

2. Shunt-Series amplifier is also called as ———— amplifier and its transfer function is ————.

3. State the Barkhausen criteria for producing sustained oscillations.

4. Which of the oscillator(s) provide greater stability of operation? Justify your answer.

5. Which of the two tuned-amplifier configurations do not suffer from Miller effect? Why?

6. Assume that the output of the tuned amplifier must be coupled to the input of another amplifier. Suggest a suitable solution to raise the effective input resistance of the second amplifier, without reducing the overall Q factor.

7. Using pn junction diode(s), draw a circuit that produce the response shown in Figure 1.

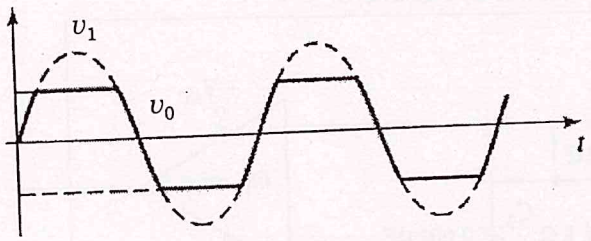

Figure 1

8. Depict the response of an RC integrator and differentiator circuits.

9. If the current gain of the two transistors in a Darlington pair configuration is 20 and 50, find the overall current gain?

10. Sketch the safe operating of a BJT considering its thermal breakdown.

PART B — (5 × 13 = 65 marks)

11. (a) Give an example of ideal shunt — shunt negative feedback amplifiers. Draw its small signal equivalent circuit and derive the gain with feedback, input resistance with feedback and output resistance with feedback.

Or

(b) For the negative feedback amplifier shown in Figure 2, $R_i = \infty$, $I_i = 100\mu A$,, $I_{fb} = 99\mu A$ and $I_0 = 5$ mA; determine A_i, β_i and A_{if}. Also determine R_{if} and R_{of} for $R_i = 5$ kΩ and $R_0 = 4$ k Ω.

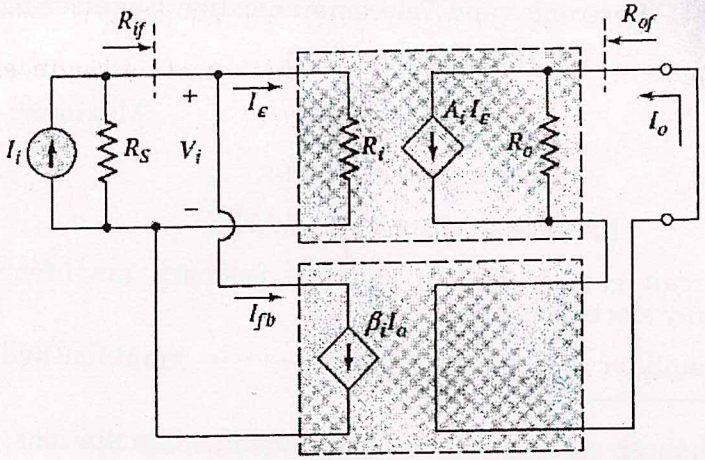

Figure 2

12. (a) Consider a three stage RC phase shift oscillator and derive an expression to determine its frequency of oscillation and the condition required for oscillation.

Or

(b) (i) Using any one of the active device, draw and explain the Hartley oscillator and derive its resonant frequency. (9)

(ii) Calculate the resonant frequency of the Wien bridge oscillator circuit shown in Figure 3. (4)

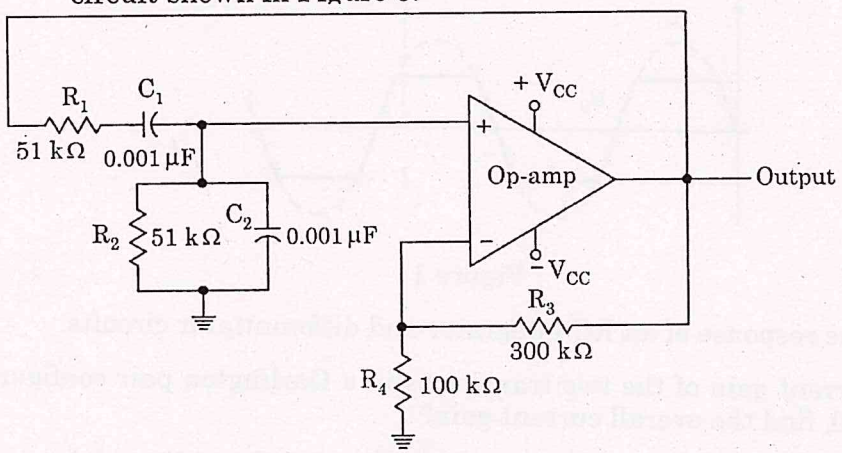

Figure 3

13. (a) Consider a MOSFET with a tuned circuit load. From its equivalent circuit, derive an expression for its voltage gain, center frequency, bandwidth, Q factor and center frequency gain. Represent the inductor losses in the tuned circuit by a relevant equation.

Or

(b) Analytically explain how synchronous tuning and stagger tuning provides maximal flatness in the pass band frequency response of tuned amplifiers.

14. (a) Trigger an op-amp based monostable multivibrator circuit and explain its operation with the signal waveforms. Derive an expression to determine the pulse duration.

Or

(b) Consider the inverting Schmitt trigger circuit shown in Figure 4 and explain its operation. Derive an expression to determine the hysteresis width. Calculate the same if $R_1 = 10$ kΩ and $R_2 = 90$ kΩ. Let $V_H = +10\,V$ and $V_L = -10\,V$.

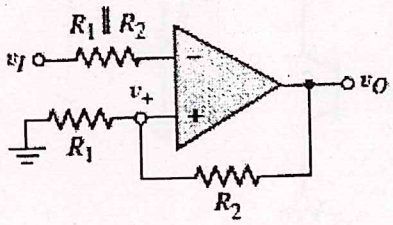

Figure 4

15. (a) (i) Relate the maximum power dissipation with that of the maximum junction temperature of the transistor. What are the different methods used to dissipate the heat produced? Draw the electrical analog of thermal conduction process when a heat sink is utilized to dissipate the heat produced in the transistor. (10)

(ii) A BJT is specified to have a maximum power dissipation of 2 W at an ambient temperature of 25°C, and a maximum junction temperature of 150°C. Find the thermal resistance. (3)

Or

(b) (i) Suggest a suitable method to eliminate crossover distortion in Class AB power amplifier. Draw a class AB output stage, its transfer characteristics, and derive an equation to determine its output resistance. (9)

(ii) Modify this power amplifier using a Darlington pair and explain its effect on the output stage. Bias the same using a V_{BE} multiplier. (4)

PART C — (1 × 15 = 15 marks)

16. (a) Design a Class B output stage as shown in Figure 5 to deliver an average power of 20 W to an 8-Ω load. The power supply should be selected such that Vcc is about 5 V greater than the peak output voltage in order to avoid transistor saturation, nonlinear distortion and provide short circuit protection. Determine the supply voltage required, the peak current drawn from each supply, the total supply power, and the power conversion efficiency. Also determine the maximum power that each transistor must be able to dissipate safely.

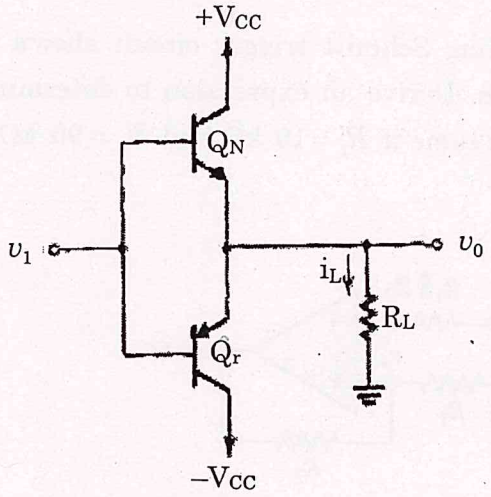

Figure 5

Or

(b) (i) A multipole amplifier having a first pole at 1 MHz and an open loop gain of 100 dB is to be compensated for closed loop gains as low as 20 dB. Use additional capacitance at the circuit node at which the first pole is formed to reduce the frequency of the first pole. If the frequency of the second pole is 10 MHz and if it remains unchanged while additional capacitance is introduced as mentioned, find the frequency to which the first pole must be lowered so that the resulting amplifier is stable for closed loop gain as low as 20 dB. By what factor must the capacitance at the controlling node be increased? (12)

(ii) If the multipole amplifier mentioned above is to be compensated by the introduction of a new dominant pole, at what frequency must the new pole be placed? (3)

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Question Paper Code : 90473

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Fourth Semester

Electronics and Communication Engineering

EC 8451 — ELECTROMAGNETIC FIELDS

(Common to Electronics and Telecommunication Engineering)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define gradient of a scalar field.

2. A vector function, $F=(4y-c_1z)\,a_x+(c_2\,x-7z)\,a_y-(c_3y+5z)a_z$. Determine the constants C_1, C_2, C_3 if F is irrotational.

3. State Coulomb's law.

4. The electrostatic field intensity E is derivable as the negative gradient of a scalar electric potential V. Determine E at the point (2,3,1) if $V=V_o\,e^{-2x}\sin(\pi y/4)$

5. State Ampere's Circuital law.

6. Vector magnetic potential in free space is $A=(2x^2\,y-yz)a_x+(xy^2-xz^2)\,a_y-(6xy+2xy)\,a_z\,(Wb/m)$. Calculate magnetic flux density (B).

7. What is the difference between conduction current and displacement current?

8. Write the boundary conditions of electromagnetic fields at air – conductor interface.

9. Write the properties of Uniform Plane Wave for free space.

10. Find the intrinsic impedance of the medium with permittivity $\varepsilon=4\,\varepsilon_0$ and permeability $\mu=\mu_0$.

PART B — (5 × 13 = 65 marks)

11. (a) (i) A vector in cylindrical coordinates is given as $A = a_r A_r + a_\phi A_\phi + a_z A_z$. Derive the relation between the components of cylindrical coordinates and cylindrical coordinates. (7)

(ii) State and explain helmholtz's theorem. (6)

Or

(b) Verify the divergence theorem for the vector function $A = x^2 a_x + xy a_y + yz a_z$ over a cube one unit on each side. The cube is situated in the first octant of the cartesian coordinate system with one corner at the origin.

12. (a) Determine the Electric field intensity (E) of an infinitely long, straight, line charge of a uniform density ρ_1 in air medium.

Or

(b) A spherical capacitor consists of an inner conducting sphere of radius R_i and outer conductor with a spherical inner wall of radius R_o. The space between the conductors is filled with a dielectric of permittivity ε. Determine the capacitance of the capacitor.

13. (a) Derive the boundary conditions for the static magnetic field at the interface of two different magnetic medium with permeability μ_1 and μ_2.

Or

(b) An air coaxial transmission line has a solid inner conductor of radius a_1 and a very thin outer conductor of inner radius b_1. Determine inductance per unit length of the line.

14. (a) Derive the integral and point form of the maxwell's equations from gauss law, ampere's law and faraday's law.

Or

(b) Derive the wave equations from maxwell's equations and solve it for free space conditions.

15. (a) Derive the expression for attenuation and phase constant for an electromagnetic wave propagating in good conductor and dielectric medium.

Or

(b) Find the poynting vector on the surface of a long, straight conducting wire that carries a direct current I. The radius and conductivity of the conductor are b and σ respectively. Verify the poynting's theorem.

PART C — (1 × 15 = 15 marks)

16. (a) (i) A long, straight copper wire with 12 mm diameter carries a steady current of 10 mA. Determine the magnetic flux density and magnetic field intensity at 3 mm and 5 cm from the centre of the wire $\left(\mu = \mu_0 = 4\pi \times 10^{-7}\, H/m\right)$. (8)

(ii) A point charge of Q = 40 nC is located at the origin in cartesian coordinates. Find the electric flux density and electric field intensity at $(1, 3, -5)$. (7)

Or

(b) (i) A copper sheet is used as cover for electromagnetic shielding applications. What is thickness of copper sheet is required at 100 MHz, 500 MHz, 3 GHz and 30 GHz for the electromagnetic shielding applications? $\left(\mu = \mu_0 = 4\pi \times 10^{-7}\, H/m,\ \sigma = 5.8 \times 10^7\, S/m\right)$. (8)

(ii) The Electric field intensity in air medium is given by $E = 10 \sin(100\pi x) \cos\left(12\pi 10^9 t - \beta z\right) a_y\, (V/m)$. Find the magnetic field intensity H and β. (7)

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Question Paper Code : 90480

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Fifth Semester

Electronics and Communication Engineering

EC 8553 — DISCRETE – TIME SIGNAL PROCESSING

(Common to : Biomedical Engineering / Computer and Communication Engineering / Electronics and Telecommunication Engineering / Medical Electronics)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Calculate the number of multiplications needed in the calculation of DFT and FFT with 8 pt sequence.

2. Compare overlap add and overlap save method.

3. What is the need for pre warping?

4. List the advantage of direct form II realisation when compared with direct form I realisation.

5. Define Gibb's Phenemenon.

6. What do you refer from limit cycle oscillations?

7. Differentiate Fixed Point and Floating Point number representations.

8. What is quantization error?

9. List the addressing modes of digital signal processer.

10. What do you understand from pipe line operation of Digital signal processer?

PART B — (5 × 13 = 65 marks)

11. (a) Summarize the following properties of DFT :

(i) Periodicity

(ii) Symmetry

(iii) Circular convolution

(iv) Linear filtering.

Or

(b) Illustrate the 8-pt DFT of a sequence $x(n) = \{0.5, 0.5, 0.5, 0.5, 0, 0, 0, 0\}$.

12. (a) Obtain the direct form I, direct form II and cascade form realisation for the given system.

$$y(n) = 0.1y(n-1) + 0.2y(n-2) + 3x(n) + 3.6x(n-1) + 0.6x(n-2)$$

Or

(b) An Analog filter has the transfer function $H(s) = \frac{10}{s^2 + 7s + 10}$. Design a digital filter equivalent using Impulse Invariant method for $T = 0.2$ sec.

13. (a) Design an ideal low pass filter with a frequency response

$$H_d(e^{jw}) = \begin{cases} 1 \text{ for } \frac{-\pi}{2} \le w \le \frac{\pi}{2} \\ 0 \text{ for } \frac{\pi}{2} \le |w| \le \pi \end{cases}.$$

Find the values of $h(n)$ for $N = 1$. Find $H(z)$.

Or

(b) Demonstrate the coefficients of a linear phase FIR filter of length $M = 15$ which has a symmetric unit sample response and a frequency response that satisfier the condition.

$$H_r\left(\frac{2\pi K}{15}\right) = \begin{cases} 1 & k = 0, 1, 2, 3, 4 \\ 0.4 & k = 5 \\ 0 & k = 6, 7 \end{cases}$$

14. (a) Describe the quantization process and errors introduced due to quantization.

Or

(b) For the II order IIR filter, the system fraction is $H(z) = \frac{1}{(1 - 0.5z^{-1})(1 - 0.45z^{-1})}$. Examine the effect of shift in pole location with 3 bit coefficient representation in direct and cascade forms.

15. (a) Give detailed note about Arithmetic Instructions.

Or

(b) Draw the various architecture used in digital signal processer. Explain each in brief.

PART C — (1 × 15 = 15 marks)

16. (a) For the given specifications, design an Chebyshev digital filter using Impulse Invariance Transformation.

$$0.9 \le |H(w)| \le 1 \quad \text{for } 0 \le w \le 0.25\pi$$
$$|H(w)| \le 0.24 \quad \text{for } 0.5\pi \le w \le \pi$$

Or

(b) Using linear convolution construct $y(n) = x(n) * h(n)$ for the sequence $x(n) = \{1, 2, -1, 2, 3, -2, -3, -1, 1, 1, 2, -1\}$ and $h(n) = \{1, 2\}$. Compare the result with by solving the problem with Overlap Add method and Overlap Save method.

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Question Paper Code : 90459

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Fifth/Seventh/Eighth Semester

Electronics and Communication Engineering

EC 8094 – SATELLITE COMMUNICATION

(Common to: Electronics and Telecommunication Engineering/ Geoinformatics Engineering)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Name the six orbital elements used to coordinate the satellite.

2. How can sun transit outage be prevented?

3. What is the use of attitude and orbit control system in a satellite?

4. Write short note on the two types of transponders used in satellites.

5. What is ionospheric scintillation?

6. State Effective Isotropic Radiated Power?

7. What is DAMA? Where it is useful?

8. Which are the preferred modulation schemes in DVB-S2 standard and why?

9. Mention the two types of codes used in GPS.

10. What is a VSAT? In which frequency band it is operated?

PART B — (5 × 13 = 65 marks)

11. (a) (i) How do you describe the orbit of a satellite? Explain with necessary equations and figure. (8)

(ii) Describe various types of orbital perturbations an Earth orbiting satellite may experience with illustration. (5)

Or

(b) (i) Describe the steps involved in locating the satellite in the orbit. (8)

(ii) Determine the geostationary Earth Orbit Radius using Kepler's third law. (5)

12. (a) Explain in detail about the communication subsystem in a satellite that uses orthogonal circularly polarized signals with block diagram and frequency plan. (13)

Or

(b) (i) Explain in detail about Station Keeping for a satellite. (6)

(ii) Explain the telemetry, tracking, command, and monitoring subsystem with block diagram. (7)

13. (a) (i) How do you find the noise temperature from the noise figure of a receiver? Also explain how GNR can be found from the G/T ratio of a receiver. (6)

(ii) An earth station antenna has a diameter of 30 m with an aperture efficiency of 68% and is used to receive a signal at 4150 MHz. At this frequency, the system noise temperature is 60 K when the antenna points at the satellite at an elevation angle of 28°. What is the earth station G/T ratio under these conditions? If heavy rain causes the sky temperature to increase so that the system noise temperature rises to 88 K, what is the new G/T value? (7)

Or

(b) (i) Write about output back-off used to reduce non-linearity at the satellite output. How is it related to input back-off? (6)

(ii) Derive a formula for the combined C/N ratio of bent-pipe transponder satellite link. (7)

14. (a) Explain in detail about the radio frequency transmission of digital data with transmitter and receiver block diagrams along with the details of time and frequency domain signals. (13)

Or

(b) Derive the processing gain and the system capacity of a DSSS CDMA system. (13)

15. (a) (i) Show with block diagram how L1 and L2 signals are generated on board a GPS satellite. (6)

(ii) Explain the C/A code generator in GPS. (7)

Or

(b) Draw and explain about:

(i) Single channel Ku-band satellite TV receiver. (6)

(ii) Four channel Ku-band LNC block to receive signal from two satellites. (7)

PART C — (1 × 15 = 15 marks)

16. (a) A digital communication system uses a satellite transponder with a bandwidth of 54 MHz. Several earth stations share the transponder using QPSK modulation using either FDMA or TDMA. Standard message data rates used in the system are 80 kbps and 2.0 Mbps. The transmitters and receivers in the system all use ideal RRC filters with $\alpha = 0.25$, and FDMA channels in the satellite are separated by 100 kHz guard bands. When TDMA is used, the TDMA frame is 125 μs in length, and a 2 μs guard time is required between each access. A preamble of 148 bits must be sent by each earth station at the start of each transmitted data burst.

(i) What are the symbol rates for the 80 kbps and 2.0 Mbps QPSK signals sent using FDMA? (3)

(ii) What is the symbol rate of each earth station's transmitted data burst when TDMA is used? (3)

(iii) Calculate the number of earth stations that can be served by the transponder when 80 kbps channels are sent using FDMA and TDMA. (4)

(iv) Calculate the number of earth stations that can be served by the transponder when 2.0 Mbps channels are sent using FDMA, and TDMA. (5)

Or

(b) A geostationary satellite carries a C-band transponder which transmits 20 watts into an antenna with an on-axis gain of 30 dB. An earth station is in the center of the antenna beam from the satellite, at 38,000 km. For a frequency of 4.0 GHz:

(i) Calculate the incident flux density at the earth station in watts per square meter and in dBW/m^2. (3)

(ii) The earth station has an antenna with a circular aperture 2 m in diameter and an aperture efficiency of 65%. Calculate the received power level in wafts and in dBW at the antenna output port. (3)

(iii) Calculate the on-axis gain of the antenna in dB. (3)

(iv) Calculate the free space path loss between the satellite and the earth station. (3)

(v) Calculate the power received, Pr, at the earth station. (3)

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Question Paper Code : 90477

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Fifth Semester

Electronics and Communication Engineering

EC 8501 — DIGITAL COMMUNICATION

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. A communication system consists of six messages with probabilities 0.125, 0.125, 0.125, 0.125, 0.25, 0.25. Determine the entropy of the communication system.

2. What is the channel capacity of a voice communication channel having bandwidth of 3100 Hz and SNR as 25 dB?

3. An audio signal comprising of a single sinusoidal term $x(t) = 5 \cos (1000 \pi t)$ is quantized using 8 bit PCM. Determine the signal-to-quantization noise ratio.

4. The binary data 1100001 is transmitted over a baseband channel. Draw the line coding waveforms for the transmitted data using (a) Unipolar RZ and (b) split phase Manchester.

5. What are the benefits and drawbacks of Nyquist pulse shaping?

6. What are the essential requirements of an equalizer?

7. Determine the bandwidth for an binary FSK signal with two frequency offsets placed at 32kHz and 24kHz, and a bit rate of 4 kbps.

8. Distinguish between coherent and non-coherent detection.

9. What are the desirable properties of linear block code?

10. What is convolutional code? Write the significance.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Prove that the entropy for a discrete source is maximum when the output symbols are equally probable. (7)

(ii) A source X has an infinitely large set of outputs with probability of occurrence given by $p(x_i) = 2^{-i}, i = 1, 2, 3, \ldots\ldots$. What is the average self- information of the source? (6)

Or

(b) Consider a discrete source with source probabilities {0.2, 0.18, 0.1, 0.1, 0.1, 0.061, 0.059, 0.04, 0.04, 0.04, 0.04, 0.03, 0.01}. Construct binary optimal code using Huffman procedure for this source. Calculate the efficiency of the code?

12. (a) Draw and explain encoder and decoder structures of DPCM. Demonstrate the need for Adaptive DPCM.

Or

(b) Explain the need for line coding schemes. What are the desirable properties for line coding schemes?

13. (a) What is correlative coding? Explain its use by illustrating duo binary signalling.

Or

(b) (i) What is the importance of equalization in communication system and mention the advantages. (4)

(ii) Explain adaptive equalizer with a neatly labelled block diagram. (9)

14. (a) Draw and explain BPSK modulation and demodulation system. What is the advantage of DPSK over BPSK?

Or

(b) Explain the necessity for carrier synchronization. Draw and explain Costas loop carrier synchronization system.

15. (a) The generator polynomial of a (7, 4) cyclic code is $1 + X + X^3$. Develop encoder and syndrome calculator for this code.

Or

(b) Using systematic procedure, compute the hamming code for the data sequence 11 0 0 0 11 0.

PART C — (1 × 15 = 15 marks)

16. (a) Consider a binary block code with encoding matrix

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

(i) Find the parity check matrix.

(ii) Determine how many errors the code can detect and correct.

(iii) Draw the encoder and syndrome computation circuit.

(iv) Devise a decoder circuit for this code. (5+4+3+3)

Or

(b) (i) Let X and Y be two discrete random variables that takes values $x_1, x_2, \ldots, x_M$ and $y_1, y_2, \ldots y_L$ respectively. Let $Z = X + Y$. Show that $H(Z / X) = H(Y / X)$. (8)

(ii) Suppose a TV displays 30 frames/second. There are 2×10^5 pixels per frame, each pixel requires 16 bits for colour display. Calculate the bandwidth required to support the transmission of TV video signal for SNR of 28dB. (7)

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Question Paper Code : 90478

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Fifth Semester

Electronics and Communication Engineering

EC 8551 – COMMUNICATION NETWORKS

(Common to : Electronics and Telecommunication Engineering)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Point out the fundamental characteristics of data communication system.
2. Classify the types of addresses in link-layer protocol.
3. What is the need of escape character?
4. Summarize the different Ethernet generations.
5. Outline the benefits of Open Shortest Path First (OSPF) Protocol.
6. Justify the strategies in transition from IPv4 to IPv6.
7. Draw the TCP header format.
8. List the Quality of Service parameters of Transport layer.
9. Write the name of components used in e-mail system.
10. Compare HTTP with persistent and Non-persistent Connection.

PART B — (5 × 13 = 65 marks)

11. (a) Explain the various layers and functions of OSI model in detail.

Or

(b) Elaborate the Address Resolution Protocol with an example in detail.

12. (a) Explain in detail about the architecture of Bluetooth and its Protocol layers.

Or

(b) Illustrate the following terms with working

(i) Routing and Forwarding (7)

(ii) Services provided by Network (6)

13. (a) Elaborate in detail about the Address Space, Address Space Allocation and IPv6 addressing.

Or

(b) Elucidate Distance Vector Multicast Routing protocol. Summarize the metrics with its calculation method.

14. (a) Evaluate the services and Applications in User Datagram Protocol in brief.

Or

(b) Write in detail about the principle of establishing QoS through Differentiated services.

15. (a) Demonstrate how SMTP Protocol is used in E-mail applications in detail.

Or

(b) Elaborate the importance of MIME with neat diagram. Give its comparison between POP-3 and IMAP-4.

PART C — ($1 \times 15 = 15$ marks)

16. (a) Construct the Forward Error Correction techniques with an example.

Or

(b) Discuss in detail about the operation of hierarchically structured OSPF protocol by considering a suitable network.

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Question Paper Code : 90453

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Fifth Semester

Electronics and Communication Engineering

EC 8073 – MEDICAL ELECTRONICS

(Common to Electronics and Telecommunication Engineering)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write the need for unipolar chest lead configuration used in the ECG measurement.

2. List the characteristics of different heart sounds.

3. What are the different types of blood cells?

4. Write the merits of indirect method for blood pressure measurement.

5. List the characteristics of a B-mode display.

6. Mention the drawbacks of AC defibrillation.

7. Define 'desiccation' with respect to electro surgery.

8. Write the principle of short wave diathermy.

9. Write the need for brain-machine interface.

10. List the applications of virtual endoscopy.

PART B — (5 × 13 = 65 marks)

11. (a) (i) What are the factors affecting electrode potential. Explain the electrode model for bio-potential surface electrode in contact with the electrolyte. (1 + 7)

(ii) Explain the structure of a floating electrode. (5)

Or

(b) (i) Explain the characteristics of different waves recorded in EEG signals. (7)

(ii) With neat diagrams, explain the different types of needle electrodes. (6)

12. (a) (i) Explain the method of blood flow measurement using ultrasound. (6)

(ii) Explain the unit used to measure oxygen saturation in blood. (7)

Or

(b) (i) Explain the automatic optical method of counting blood cells. (6)

(ii) With a neat diagram, explain the electromagnetic blood flowmeter. (7)

13. (a) (i) Differentiate external and internal defibrillation? Also, draw and explain the capacitive discharge DC defibrillator in detail. (3 + 5)

(ii) Explain the asynchronous pacemaker in detail. (5)

Or

(b) (i) With a neat diagram, explain the ultrasound transducer in detail. (8)

(ii) Explain the types of ventilators based on the mode of cycling between inspiration and expiration. (5)

14. (a) (i) Explain the monopolar and bipolar technique used in Electro surgical unit. Which technique is better and why? Also, explain the three main categories of risks associated with ESU. (8)

(ii) What are the safety precautions to be considered while using electro surgery? (5)

Or

(b) (i) Write a note on the different electrodes used in surgical diathermy. (8)

(ii) Explain the different waveforms used in surgical diathermy. (5)

15. (a) What is modulation? Explain with a block diagram a single channel telemetry system. Also, mention the requirements for distortion-free transmission of ECG. (2 + 5 + 6)

Or

(b) With a block diagram, explain the telemetry system for transmission of ECG and respiration signal. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Interpret the code 'VVT' and explain the pacemaker identified by this code.

Or

(b) Identify and explain the defibrillator that is synchronized with the heart's activity.

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Question Paper Code : 90481

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Sixth Semester

Electronics and Communication Engineering

EC 8651 — TRANSMISSION LINES AND RF SYSTEMS

(Common to Electronics and Telecommunication Engineering)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define reflection factor and return loss.

2. Why loading of transmission line is done?

3. A loss less transmission line has L=2mH and C=8nf. Find the characteristic impedance and propagation constant at a frequency of 10 MHz.

4. A transmission line of characteristic impedance 75 ohms is terminated by resistance which has VSWR of 3. Find reflection coefficient at the load and load resistance.

5. Calculate the length of short circuit line to give an impedance of +j 20 ohms. The characteristic impedance of the line is 100 ohms.

6. A certain line of Ro=100 ohms is short at the termination. Find the impedance seen by the generator connected at a point $\frac{\lambda}{2}$.

7. What is dominant mode of propagation for rectangular waveguide?

8. A parallel plane guide having distance between them as 4 cm is filled with dielectric material with dielectric constant of 2. Find the cut off frequency, for TM_{11} mode.

9. Define cutoff frequency of microwave transistor.

10. Define stability of power amplifier.

PART B — (5 × 13 = 65 marks)

11. (a) Define transmission line parameters. Derive the transmission line equations from the equivalent circuit representation.

Or

(b) A generator of 2 volt and 10 MHz frequency is connected to a transmission line which has series impedance of 50+j50 ohms/km and shunt admittance of (2+j4) × 10^{-6} ohms/km. Find the characteristic impedance and propagation constant. Find the power delivered to the load impedance of impedance 100+j 100 ohms.

12. (a) Define the reflection coefficient and voltage standing wave ratio and draw the voltage and current waveforms when the transmission line is terminated by matched load, short circuit, open circuit and reactance terminations.

Or

(b) Find the required value of Zo of the transmission line of length $\beta l = \pi/2$ that will match 10 ohms load resistance to the generator. The generator internal resistance is 200 ohms. Find the VSWR and reflection coefficient on the line.

13. (a) A line of R_o = 300 ohms is connected to a load of 80 ohms resistance. For a frequency of 1MHz, find the length, termination of single stub nearest to the load to produce an impedance match. (Use smith chart).

Or

(b) Explain single stub matching of transmission line and derive the expressions.

14. (a) Discuss the characteristics: cut off frequency, cut off wave length, phase velocity, wave length, group velocity, and wave impedance for TE, TM and TEM waves between two conducting planes.

Or

(b) Derive the field expressions for Transverse Magnetic wave in a rectangular waveguide. Draw the field distribution for the lowest order mode.

15. (a) With neat diagram explain the stability consideration in design of RF amplifiers.

Or

(b) Explain the basic concepts and design of mixer.

PART C — (1 × 15 = 15 marks)

16. (a) A line is one wave length long and is open circuited. If a supply of 1 volt amplitude and 1 kHz frequency is connected to it. Find the incident, reflected and total voltage at $\lambda/16$ distance from the short. The line parameters are R=50 ohms, L=0.001 Henry, C=0.06 μF and 0=1.5 ohms.

Or

(b) A lossless line (7/16) λ long has an input impedance $Z_s / R_0 = 1.5 + j1.5$. Find the load impedance and standing wave ratio, amplitude and phase of reflection coefficient.

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Question Paper Code : 90460

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Sixth/Seventh Semester

Electronics and Communication Engineering

EC 8095 – VLSI DESIGN

(Common to : Electrical and Electronics Engineering/Electronics and Instrumentation Engineering/Electronics and Telecommunication Engineering/Instrumentation and Control Engineering/Robotics and Automation)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Draw a 2-input CMOS NOR gate.

2. By what factor R_{DS} should be scaled, if constant electric field scaling is employed?

3. Using transmission gate draw a 4:1 MUX.

4. What is charge sharing in dynamic CMOS logic?

5. State the use of Schmitt Trigger.

6. Draw a MUX based negative level sensitive D-latch.

7. Compare SRAM and DRAM.

8. Draw a 1-transistor DRAM cell.

9. Define controllability and observability.

10. Mention the advantages of BIST.

PART B — (5 × 13 = 65 marks)

11. (a) With neat diagram, enumerate in detail the DC characteristics of CMOS inverter. (13)

Or

(b) (i) Analyze the switching characteristics of a CMOS inverter. Derive rise time, fall time and propagation delay. (6)

(ii) If two CMOS inverters are cascaded with an aspect ratio of 1:1 then determine the inverter-pair delay. (7)

12. (a) (i) Design a half adder using static CMOS logic. (6)

(ii) Design a 4:1 MUX using 2:1 MUX. Realize it using transmission gate. (7)

Or

(b) Realize a 2-input NOR gate using static CMOS logic, Domino logic and Complementary pass transistor logic. Analyze the hardware complexity in terms of transistor count. (13)

13. (a) (i) Enumerate in detail on the design of pulse registers. (6)

(ii) Give in detail, the design and working of astable sequential circuits. (7)

Or

(b) (i) Design a master-slave positive edge triggered D-flipflop using transmission gate. (6)

(ii) Discuss on sense amplifier based registers. (7)

14. (a) Describe the hardware architecture of a 4-bit signed array multiplier. (13)

Or

(b) (i) Elaborate in detail the design of a 4-bit barrel shifter. (6)

(ii) Describe the working of 6-transistor SRAM cell. (7)

15. (a) Explain in detail the basic architecture of FPGA with a neat diagram. (13)

Or

(b) Enumerate in detail the working of

(i) Adhoc Test (5)

(ii) Scan based Test (8)

PART C — (1 × 15 = 15 marks)

16. (a) Apply Radix-2 booth encoding to perform multiplication between two 8-bit numbers (-5) and 4. (15)

Or

(b) (i) Design a 4-bit carry look ahead adder using dynamic CMOS logic by deriving the necessary expressions. (6)

(ii) Design a 3-bit even parity generator using NAND gates only. Design the circuit using static CMOS logic. (9)

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Question Paper Code : 90482

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Sixth Semester

Electronics and Communication Engineering

EC 8652 — WIRELESS COMMUNICATION

(Common to : Computer and Communication Engineering/Electronics and Telecommunication Engineering)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is Doppler shift? Derive the expression of Doppler shift.

2. (a) State the conditions for frequency selective fading channel.

   (b) If the rms delay spread is 2 μs, what could be the minimum signal period to avoid ISI.

3. Handoff threshold should neither be too large nor too small-justify.

4. Mention the drawbacks of cell splitting in cellular mobile communication.

5. What is inter-block interference? How can it be removed?

6. In Minimum Shift Keying, let δf be the change in carrier frequency from f_{c1} to f_{c2} due to the transition from 0 to 1 and T_b is the bit duration. Express δf in terms of T_b. If $f_c = \frac{f_{c1} + f_{c2}}{2}$, express f_{c1} and f_{c2} in terms of f_c and δf.

7. What is the function of an equalizer in a communication system? Write the major drawback of the zero-forcing equalizer?

8. How diversity techniques helps in combating fading? Write down the use of Microscopic and Macroscopic diversity techniques.

9. Explain how MRC diversity improves the capacity of a MIMO system.

10. What is the difference between frequency diversity and time diversity? Give one example for each type of diversity.

PART B — (5 × 13 = 65 marks)

11. (a) (i) What is coherence time? Define fast fading and slow fading.

(ii) (1) Calculate the mean excess delay and rms delay spread for the multipath profile given in figure 1.

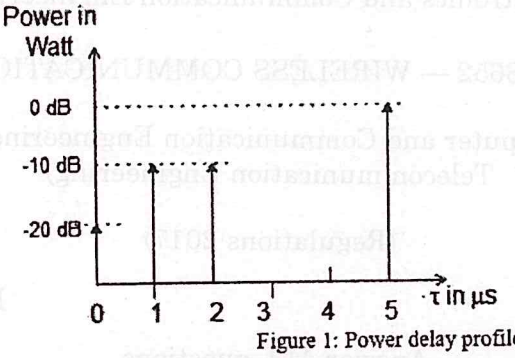

Figure 1: Power delay profile

(2) Find the type of fading if the modulated symbol duration is 10 μs.

(3) Estimate the coherence bandwith for 50% correlation of the channel. (3+5+3+2)

Or

(b) (i) How the received signal power in the case of Two-ray model is different from free-space propagation model.

(ii) A mobile phone that is 5 kilometres away from a base station receives cellular radio signals using a vertical monopole antenna with effective aperture 0.016 m². At a distance of 1 km from the transmitter, the E-field is measured to be 0.001 V/m. The carrier frequency is used in this system is 900 MHz. Find the received electric field and power at the mobile using the two-way ground reflection model assuming the height of the transmitting antenna is 50 m and the receiving antenna is 1.5 m above ground.

(iii) Estimate the median path loss using Okumura's model for d = 50 Km, h_{te} =100 m and h_{re} =10 m in an suburban environment, if the base station transmitter transmits with 2 kW at a carrier frequency of 900 MHz, find the received power at the receiver (transmitting antenna gain = 2, receiving antenna gain = 3).

$G_{area} = 9\,dB$; $A_{mu}(900\,MHZ, 50\,Km) = 43$ dB. (3+6+4=13)

12. (a) (i) Why dynamic channel assignment strategy is better compared to the fixed channel assignment in cellular networks?

(ii) During the busy hour, 1000 calls were offered to a group of trunks and 10 calls were lost. The average call duration is 2 minutes. Estimate the traffic carried and GOS.

(iii) A cellular service provider decides to use a TDMA scheme that can tolerate SIR of 15 dB in worst case and n = 3. Find the cluster size in the case of

(1) Omni-directional antenna.

(2) 120° sectoring

(3) 60° sectoring

(4) Out of 120° sectoring and 60° sectoring, which one is better. (3+3+7=13)

Or

(b) (i) Explain the umbrella cell concept in connection with cellular communication.

(ii) How microcell zone concept helps is reducing hand-offs?

(iii) Consider a cluster of seven cells. There are a total of 105 channels. Each cell has a surface area of 5 square kilometers. The probability of a call being delayed is 0,05. Find the probability that a call will be delayed for more than 5 seconds if the traffic intensity and arrival rate per user is 0.029 Erlang and 1 call every hour. (3+6+4)

13. (a) (i) Explain the working principle of OFDM and mention its mathematical equation with proper diagram.

(ii) A 64 Kbps voice frame is to be modulated by OFDM scheme. The duration of OFDM symbol is 1000 μs. Total of 32 subcarriers are to be designed to this frame. Find

(1) The null-to-null sub-channel BW

(2) Total BW occupied, and

(3) The number of bits in OFDM frame. (7+6=13)

Or

(b) (i) Explain the working principle of MSK with proper block diagram.

(ii) Binary data is transmitted using MSK at a rate of 1 Mb/s over a RF link having bandwidth of 3 MHz. assume the noise power spectral density at the coherent receiver input to be 10^{-10} W/Hz, find the maximum signal power per bit required at the receiver input to maintain the probability of error less than or equal to 2×10^{-6}. Given $erfc^{-1}\left(2\times10^{-6}\right) = 3.3$. (6+7=13)

14. (a) (i) What is selection combining technique? Describe the selection combining technique with proper diagram.

(ii) If the number of diversity branches is 3, the average SNR is 10 dB. Find the improvement in SNR achieved through diversity.

(iii) In a communication system, Selection Combining technique is employed at a receiver to detect the message signal where the links are Rayleigh faded

(1) Determine the order of diversity such that the instantaneous SNR doesn't drop below 10 dB to keep the outage probability less than or equal to 0.00086178. Consider the average link SNR is 20 dB,

(2) Find the improvement in SNR for the above scenario. (6+2+5=13)

Or

(b) (i) Write down the working principle of RAKE receiver. Write down the advantages of using Rake receiver.

(ii) Write down the working principle of LMS algorithm with necessary equation.

(iii) The received signal at a receiver is combined with Maximal Ratio Combining technique. There are four diversity branches and each one is Rayleigh faded.

(1) Determine probability of distribution of the modified instantaneous SNR γ_i if the average link SNR is 20 dB.

(2) Estimate the improved in link capacity for 10 KHz channel bandwidth and compare the same with and without diversity case. (4+4+5=13)

15. (a) (i) Write down the difference between transmitter diversity and receiver diversity. Why receiver diversity is better than transmit diversity.

(ii) In a 2 × 1 communication system, a transmitter transmits a message signal over a wireless medium. The received signal vectors at the receiver antennas are described as follows :

$$\begin{bmatrix} y_1 \\ y_2 \end{bmatrix} = \begin{bmatrix} h_1 \\ h_2 \end{bmatrix} x + \begin{bmatrix} n_1 \\ n_2 \end{bmatrix}$$

where h_i is link coefficient, and n_i is the additive white Gaussian noise, $i = 1,2$. Find the beam forming vector for this given diversity.

(iii) In a MIMO system, let $\bar{x}$ be the transmit vector, $\bar{y}$ be the received vector and H be channel matrix. Show that the estimated signal for zero-forcing receiver is $\hat{x} = \left(H^T H\right)^{-1} H^T \bar{y}$. (4+3+6=13)

Or

(b) (i) Design the received signal model for a 3 × 2 MIMO system.

(ii) What is spatial multiplexing? How it improves the system performance?

(iii) Consider a MIMO system with number of receiving antennas (r) = 3. Let the noise vector be $\overline{n}$ where $E\left\{|n_i|^2\right\}=1/2$ and $E\{n_i\ n_j\}=0$ while $i\neq j$. Show that the covariance matrix (R) is $R=\frac{1}{2}I_{3\times 3}$ where $\overline{n}=\begin{bmatrix} n_1 \\ n_2 \\ n_3 \end{bmatrix}$. (3+4+6=13)

PART C — (1 × 15 = 15 marks)

16. (a) Consider a 1 × 1 communication system where the channel coefficient between a transmitter and a receiver is $h=\frac{1}{\sqrt{2}}+j\frac{1}{\sqrt{2}}$. The transmitter transmits a message with the power of 0.1 W. Find the received SNR and channel capacity of the given system considering the channel bandwidth is 10 KHz, and noise variance $\left(\sigma^2\right)$ is 1. Given $\log_{10}(1.1)=0.04139$. Now, the system is upgraded to a 2 × 1 communication system where the channel coefficients between a transmitter and a receiver are $h_1=\frac{1}{\sqrt{2}}+j\frac{1}{\sqrt{2}}$ and $h_2=\frac{1}{\sqrt{2}}-j\frac{1}{\sqrt{2}}$ respectively. For the same transmit power, channel bandwidth, and noise variance finds the impact on SNR and capacity. Given $\log_{10}(1.2)=0.07918$.

Or

(b) (i) In a typical communication system, OFDM scheme is used to modulate the frames. If the OFDM symbol duration is 1280 μs and it reaches the receiver after 450 ns, answer the following :

(1) What should be the minimum duration of cyclic prefix? What would be the OFDM duration after appending the cyclic prefix?

(2) If 64 point IFFT is used for frame modulation, how much spectrum is required for transmission?

(3) If one sample period is cyclically prefixed, would it be enough to avoid ISI? Justify your answer.

(ii) For a vehicle travelling 50 m/s using a 900 MHz carrier, find the coherence time of the channel. Given the duration of a frame is 20 ms, determine the number of fades the frame has to face while it is transmitted over the channel. If the frame has to avoid the impact of fading, what should be the frame duration?

(iii) The sum of squared errors between measured and estimated values of the received powers is given by 147 dB, It is assumed that the path loss for these measurements follows the model of Log Normal Shadowing, where the reference distance is $d_0 = 100\,m$, received power at reference distance is 0 dBm and $n = 3$.

(1) Calculate the standard deviation of shadowing about the mean value.

(2) Estimate the received power at $d = 2\,\text{km}$ using the Log-distance model. (6+4+5=15)

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Question Paper Code : 90441

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Sixth Semester

Electronics and Communication Engineering

EC 8002 – MULTIMEDIA COMPRESSION AND COMMUNICATION

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Perform DPCM on a data sequence $\{8,10,10,10,13,12,14,16,15,19,20\}$ and compute its Compression Ratio.

2. Write the significance of subband coding in speech compression.

3. What is Tagged image file format?

4. How MPEG-2 motion estimation is performed?

5. For the image $f(x,y)$ shown below, compute the degree of compression that can be achieved using horizontal run length coding, assuming 2 bits to represent the pixel value and 2 bits to represent the run length

$$f(x,y)=\begin{bmatrix}4 & 4 & 4 & 3\\ 3 & 4 & 4 & 4\\ 4 & 3 & 3 & 3\\ 3 & 2 & 2 & 1\end{bmatrix}$$

6. To transmit an RGB image 512×512, 24 bpp via a modem at 56kb. Find the time taken to transmit?

7. Define Traffic shaping?

8. What is Laissez-faire approach?

9. What is end to end delay?

10. Write the types of Media Synchronization?

PART B — (5 × 13 = 65 marks)

11. (a) G.722 provides a high quality speech at 64kbps. How – Justify the statement.

Or

(b) Explain the structural properties and characterization of vector quantizer and also discuss the performance measurement of a vector quantizer.

12. (a) With neat sketch, Design ITU-T H.263 encoder and its Motion Compensation algorithms.

Or

(b) Discuss the design principles of JPEG standard with its transform computational features, Quantization and coding scheme.

13. (a) A source emits four symbols $\{a, b, c, d\}$ with the probabilities 0.4, 0.2, 0.1 and 0.3 respectively. Construct arithmetic coding to encode the word "dad".

Or

(b) A sequence is encoded using LZW algorithm and the initial dictionary shown in the table below.

Index	Entry
1	a
2	b
3	h
4	i
5	s
6	t

The encoder output sequence as follows: Decode the sequence

6 3 4 5 2 3 1 6 2 9

11 16 12 14 4 20 10 8 23 13

14. (a) Enumerate the significance of Resource Reservation Protocol with its principle and DiffServ architecture.

Or

(b) Discuss the principle of Best effort service model with its scheduling and dropping policies to achieve QoS.

15. (a) Demonstrate how Transport protocol addresses the transfer of real time digital streams and its system level issues.

Or

(b) Explain in detail about the data stream characteristics for continuous Media.

PART C — (1 × 15 = 15 marks)

16. (a) Encode and decode the following sequence using the LZ77 algorithm

dbcsbdbebcsbssbssbe

Assume a window size of 13 with look-ahead buffer size of 6 and search buffer of size 7.

Or

(b) Consider the message {b b r d v b r k}, where alphabet consist of 26 lower case letters of English alphabet and $(e = 4$ and $r = 10)$. Encode and decode the sequence using Adaptive Huffman coding.

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Question Paper Code : 90460

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Sixth/Seventh Semester

Electronics and Communication Engineering

EC 8095 – VLSI DESIGN

(Common to : Electrical and Electronics Engineering/Electronics and Instrumentation Engineering/Electronics and Telecommunication Engineering/Instrumentation and Control Engineering/Robotics and Automation)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Draw a 2-input CMOS NOR gate.

2. By what factor R_{DS} should be scaled, if constant electric field scaling is employed?

3. Using transmission gate draw a 4:1 MUX.

4. What is charge sharing in dynamic CMOS logic?

5. State the use of Schmitt Trigger.

6. Draw a MUX based negative level sensitive D-latch.

7. Compare SRAM and DRAM.

8. Draw a 1-transistor DRAM cell.

9. Define controllability and observability.

10. Mention the advantages of BIST.

PART B — (5 × 13 = 65 marks)

11. (a) With neat diagram, enumerate in detail the DC characteristics of CMOS inverter. (13)

Or

(b) (i) Analyze the switching characteristics of a CMOS inverter. Derive rise time, fall time and propagation delay. (6)

(ii) If two CMOS inverters are cascaded with an aspect ratio of 1:1 then determine the inverter-pair delay. (7)

12. (a) (i) Design a half adder using static CMOS logic. (6)

(ii) Design a 4:1 MUX using 2:1 MUX. Realize it using transmission gate. (7)

Or

(b) Realize a 2-input NOR gate using static CMOS logic, Domino logic and Complementary pass transistor logic. Analyze the hardware complexity in terms of transistor count. (13)

13. (a) (i) Enumerate in detail on the design of pulse registers. (6)

(ii) Give in detail, the design and working of astable sequential circuits. (7)

Or

(b) (i) Design a master-slave positive edge triggered D-flipflop using transmission gate. (6)

(ii) Discuss on sense amplifier based registers. (7)

14. (a) Describe the hardware architecture of a 4-bit signed array multiplier. (13)

Or

(b) (i) Elaborate in detail the design of a 4-bit barrel shifter. (6)

(ii) Describe the working of 6-transistor SRAM cell. (7)

15. (a) Explain in detail the basic architecture of FPGA with a neat diagram. (13)

Or

(b) Enumerate in detail the working of

(i) Adhoc Test (5)

(ii) Scan based Test (8)

PART C — (1 × 15 = 15 marks)

16. (a) Apply Radix-2 booth encoding to perform multiplication between two 8-bit numbers (-5) and 4. (15)

Or

(b) (i) Design a 4-bit carry look ahead adder using dynamic CMOS logic by deriving the necessary expressions. (6)

(ii) Design a 3-bit even parity generator using NAND gates only. Design the circuit using static CMOS logic. (9)

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Question Paper Code : 90487

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Seventh/Eighth Semester

Electronics and Communication Engineering

EC 8791 – EMBEDDED AND REAL TIME SYSTEMS

(Common to : Biomedical Engineering / Medical Electronics)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List two special functional units of an embedded processor used for audio player design.

2. What is meant by requirement analysis if doing memory scaling for a video accelerator?

3. Depict the three address format for instructions in ARM processors.

4. Explain the operation of instruction

   ADD r3, r2, r1, LSL # 3; r3 := r2 + 8 × r1

5. State the use of break point and watch point support in ARM debugging.

6. Give one difference between ARM Stack and Heap.

7. State the advantage of inclusion of instruction and data cache in ARM uC.

8. State how the control of aborting of illegal memory accesses help in fault tolerance.

9. Give one challenge in developing of codes for MPSoCs.

10. How does the ARM SAP instruction provides atomic executions?

PART B — (5 × 13 = 65 marks)

11. (a) Give the Building blocks for one consumer electronic product application system built using a typical embedded processor. Give any two features in the selected processor that make its role effective in defining the product requirement analysis. (9+4)

Or

(b) Write briefly on the following for embedded system design:

(i) Model train controller (7)

(ii) designing with computing platform (6)

12. (a) With neat diagram, describe the functional blocks for one ARM microcontroller. (13)

Or

(b) Describe for one application based on ARM microcontroller, the programming control of

(i) Timer Unit (6)

(ii) PWM Unit. (7)

13. (a) Discuss on how the inclusion of ARM processor with these enhances the processor performance:

(i) Integer unit and Floating point unit (7)

(ii) Coprocessor unit (6)

Or

(b) Discuss on how the inclusion of ARM processor with more than 3 pipeline stages enhances the processor performance.

14. (a) Write briefly on:

(i) Memory management in ARM processor (7)

(ii) AMBA (6)

Or

(b) Give brief note on:

(i) Scheduling of real time systems (7)

(ii) Fault tolerance techniques (6)

15. (a) Explain the following:

(i) Video accelerator (7)

(ii) Distributed embedded process (6)

Or

(b) Write short notes on:

(i) Distributed Embedded Systems (7)

(ii) MPSoCs (6)

PART C — (1 × 15 = 15 marks)

16. (a) Explain briefly on how multitasking capacity of RTOS helps in engine control unit automation.

Or

(b) Enumerate on the need for Host based system for stages of: simulation, porting kernels, estimating program run times in embedded application deployment.

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Question Paper Code : 90484

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Seventh Semester

Electronics and Communication Engineering

EC 8701 — ANTENNAS AND MICROWAVE ENGINEERING

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Calculate the far field for a half wave dipole antenna operating at a frequency of 300MHz.
2. Write the Friis transmission equation and mention the significance.
3. Define Directivity and maximum effective aperture of an infinite small dipole?
4. Name any two aperture antennas and mention the difference.
5. Explain the principle Pattern Multiplication.
6. Compare Broadside and End fire arrays.
7. List any two applications of Magic Tee.
8. Why slow wave structures are used in TWT?
9. What is the need for impedance matching in microwave circuits?
10. What will be the two possible values of LO frequency, for a down-conversion mixer with input RF frequency of 5GHz and desired intermediate frequency of 500 MHz?

PART B — (5 × 13 = 65 marks)

11. (a) Draw the radiation pattern of any one microwave antenna and explain the following:

    (i) Main lobe

    (ii) Sidelobes

    (iii) Backlobes

    (iv) HPBW

    (v) FNBW (4+3+3+3)

Or

(b) Define and mention the significance of the following antenna parameters with relevant formulas:

(i) Antenna Gain

(ii) Antenna Efficiency

(iii) Effective Area

(iv) Antenna Noise Temperature (4+3+3+3)

12. (a) Derive expressions for the fields radiated from a half wave Dipole and determine its radiation resistance.

Or

(b) Explain the principle of operation of parabolic reflector antenna and detail about the different types of feeding techniques applied.

13. (a) Derive the field strength and draw the radiation pattern of two isotropic point sources separated by $d = \lambda/2$ with equal amplitude and phase.

Or

(b) Consider a uniform linear array with two isotropic point sources having $\lambda/2$ spacing between them and fed with currents of equal magnitude and opposite phase. Derive expression for its array factor and draw its radiation pattern.

14. (a) Explain the principle of operation of Magic Tee and derive its S matrix.

Or

(b) With neat diagram, explain the construction and operating principle of TWT amplifier.

15. (a) Define Power Gain, Available power gain and Transducer power gain. Derive expressions for these power gains in terms of S parameters.

Or

(b) Explain the principle of obtaining frequency up conversion and down conversion using mixer.

PART C — ($1 \times 15 = 15$ marks)

16. (a) A log-periodic dipole array antenna is to be designed for frequency range of 800 MHz to 2000 MHz for a directivity of 9 dBi. The optimum values of ζ and σ are 0.86 and 0.16, respectively. A wire of 0.1 cm diameter is to be used. Calculate the approximate lengths of the longest and shortest dipoles that are to be used, the number of elements in the array and lengths of each array element.

Or

(b) Design a rectangular microstrip antenna for WiFi application at 2.4415 GHz. Choose a substrate material with $\varepsilon_r = 2.32; h = 0.16$ cm; $\tan\delta = 0.001$.

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Question Paper Code : 90485

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Seventh Semester

Electronics and Communication Engineering

EC 8702 – ADHOC AND WIRELESS SENSOR NETWORKS

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List down any four challenges of the routing protocol in adhoc wireless networks.

2. Mention the significance of power aware routing in adhoc wireless networks.

3. What is the need for dynamic modulation scaling in a transceiver used in wireless sensor node?

4. Energy scavenging in WSN : Comment.

5. Differentiate flooding and gossiping.

6. List the objective of PAMAS.

7. Evaluate the impact of black hole attack in routing protocols.

8. Write the importance of flooding attack in secure routing.

9. How does TinyOS support Berkeley mote?

10. What is the need for nesC. language in sensor network programming?

PART B — (5 × 13 = 65 marks)

11. (a) (i) Discuss the design goals and challenges in Adhoc wireless networks. (8)

(ii) What role does the routing protocol play in the provisioning of QoS guarantees for adhoc wireless networks? Explain. (5)

Or

(b) There are 12 nodes from A to L formed an adhoc network. Node A wants to send packet to L. Using DSDV explain how path is established and packets are transferred. For each stage show the routing table. During the transaction process, show the effect of breaking the link at the node F. (13)

12. (a) Explain the transceiver characteristics and structure used in the sensor node. (13)

Or

(b) (i) Explain how the sensor networks are deployed for Military and Synthetic Aperture Radar (SAR) application. (7)

(ii) Derive the expression for energy consumption in a sensor node with an appropriate diagram. (6)

13. (a) List down the routing protocol design issues of WSN and explain in detail the design issues to be considered to achieve efficient communication. (13)

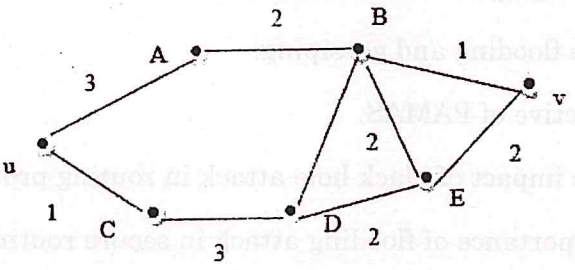
Or

(b) Consider the network topology graph given below. The numbers on the edges indicate the distance between two points. SMECN is used to construct a minimum exposure path between u and v. What is the shortest path between u and v in terms of distance? What is the minimum energy path if (13)

(i) $t = 5 \times c$?

(ii) $t = 4 \times c$?

(Assume the path loss exponent to be 2)



14. (a) How the SPIN protocol provides authenticated broadcast for resource-constrained environments? What are the three main design issues of this protocol? Give your suggestion to overcome this problem. (13)

Or

(b) Identify the Key management schemes in Wireless Sensor Networks. Illustrate the key distribution and management mechanism required for secure communication in sensor networks. (13)

15. (a) Describe about the execution models of Node-Level Simulators. Formulate the characteristics of cycle-driven and discrete-event simulators in terms of timing behaviour. (13)

Or

(b) Discuss the issues to be addressed using abstractions during the design of sensor network to ensure the correctness and efficiency of the system. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Describe the following simulators used in wireless sensor networks:

(i) ns-2 simulator (5)

(ii) TOSSIM simulator (5)

(iii) COOJA simulator (5)

Or

(b) How is the operating system like TinyOS, nesC, CONTIKIOS designed for the sensor node and discuss the design challenges of these Operating System. (15)

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Question Paper Code : 90486

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Seventh Semester

Electronics and Communication Engineering

EC 8751 — OPTICAL COMMUNICATION

(Common to : Computer and Communication Engineering)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Depict a practical optical communication system.

2. Suppose we have a 50 μm diameter graded-index fiber with a parabolic refractive index profile (α=2). If the fiber has a numerical aperture NA = 0.22, what is the total number of guided modes at a wavelength of 1310 nm?

3. Plot attenuation versus wavelength for a typical glass fiber showing major attenuation windows.

4. A 62.5/125 mm step index fiber has a core and cladding refractive index values of 1.50 and 1.48, respectively, at a wavelength of operation of 1330 nm. Estimate the value of the critical radius of curvature from the viewpoint of macro-bending loss.

5. Compare Light Emitting Diode (LED) and Laser Diode (LD) light source.

6. List out the required characteristics of the photodetector used for optical fiber communication.

7. An engineer wants to find the attenuation at 1310 nm of a 4.95-km long fiber. The only available instrument is a photodetector which gives an output reading in volts. Using this device in a cutback attenuation setup, the engineer measures an output of 6.58 V from the photodiode at the far end of the fiber. After cutting the fiber 2 m from the source, the output voltage from the photodetector now reads 2.21V. What is the attenuation of the fiber in dB/km?

8. What are various noise sources and disturbances in an optical pulse detection mechanism?

9. Draw the basic EPON architecture and operational concept.

10. An engineer wants to create a link consisting of 40 m of OM2 fiber that has a 500-MHz Bandwidth and 100 m of OM3 fiber that has a 2000-MHz bandwidth. What is the effective maximum link length?

PART B — (5 × 13 = 65 marks)

11. (a) (i) Depict the basic concept of total internal reflection and critical angle relevant to optical fiber. (5)

(ii) Elaborate on the formation of modes in a planar waveguide structure. (8)

Or

(b) (i) Write a short note on a method that was developed by Izawa et al. for continuous production of low-loss fiber in a controlled environment. (6)

(ii) Brief about the mode field diameter and propagation modes of a single mode fiber. (7)

12. (a) Explain about various scattering losses that occur when light propagates through the fiber. (13)

Or

(b) With necessary expressions, write a short note on

(i) Material dispersion (7)

(ii) Polarization mode dispersion. (6)

13. (a) Illustrate a typical GaAs/AlGaAs double-heterostructure injection laser diode and give the expression for optical confined factor and normalized waveguide thickness. (13)

Or

(b) Illustrate the operating principle of PIN photodetector and derive the expression for its Noise equivalent power. (13)

14. (a) Derive the expression for error probability (P_e), if the probabilities of 0 and 1 pulses are equally likely at the optical receiver. (13)

Or

(b) Describe the various splicing techniques used to create a permanent or semi-permanent joint between two fibers. (13)

15. (a) Explain about SONET/SDH transmission formats and speed, SONET/SDH rings and SONET/SDH Networks. (13)

Or

(b) Write about the soliton parameters and derive the expression for soliton width and spacing. (13)

PART C — (1 × 15 = 15 marks)

16. (a) An STM-1 ring is spliced every 2 km (spice loss: 0.3 dB per splice) and the modal-dispersion-induced fiber rise time is 2 ns. For the parameters given below, what is the longest link possible for a single mode fiber? And state whether the fiber rise time resulting from GVD limits the link length.

Transmitter	Receiver
Wavelength : 1310 nm	Receiver sensitivity : 32 dB
Output Power : –15 dBm	Rise time : 1 ns
Rise time : 1.3 ns	Loss : 0.35 dB/km for 1310 nm
Spectral width : 5 nm	Connector loss : 1dB
Connector loss : 1 dB	

Or

(b) The rise time of the transmitter and receiver is specified as 0.25 ns and 0.35 ns, respectively. Consider the following parameters: modal-dispersion-induced fiber rise time is 3.9 ns^2, dispersion is 2 ps/km-nm, the spectral width of the source is 3 nm, and link length is 50 km. State whether 1 Gbps is feasible for OOK-NRZ and OOK-RZ modulation formats in a single mode fiber.

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