Seat No. _____ Enrolment No. _____

THE CHARUTAR VIDYA MANDAL UNIVERSITY

M. Sc. Physics – SEMESTER 3

WINTER 2021 EXAMINATION

Course Title: Semiconductor Science

Course Code: 101510301

Total Printed Pages: 02

Date: 16/11/2021 **Time: 10.00 am to 12.00 pm** **Maximum Marks: 60**

Instructions:

- Attempt all questions.
- Numbers to the right indicate full marks for each question.
- Make suitable assumptions wherever necessary.

Q. 1 **Answer the following multiple-choice questions.** **(12)**

(1) The _____ is a simplified model for an electron in a one-dimensional periodic potential.

a) Kronig-Penney model b) Bohr model

c) Arrhenius model d) Liquid drop model

(2) A virtue of the _ _ _____ model is that it is possible to analyse the energy eigenvalues and eigenfunctions analytically.

a) Davisson and germer model b) Kronig-Penney model

c) Rutherford model d) Bohr model

(3) In condensed matter physics, _____ states that solutions to the Schrödinger equation in a periodic potential take the form of a plane wave modulated by a periodic function.

a) Green theorem b) Stokes theorem

c) Bloch's theorem d) Gauss theorem

(4) _____ is defined as the production of a voltage difference across an electrical conductor which is transverse to an electric current, and concerning an applied magnetic field, it is perpendicular to the current.

a) Stark effect b) Photoelectric effect

c) Crompton effect d) Hall effect

(5) The _____ is used for obtaining information regarding the semiconductor type, the sign of charge carriers, to measure electron or hole concentration and mobility.

a) Hall effect b) Zeeman effect

c) Stark effect d) Raman effect

(6) The _____ of a solid-state body is the thermodynamic work required to add one electron to the body.

a) Conduction band b) Fermi level

c) Valence band d) Vacuum level

(7) A _____ is an interface between two layers or regions of dissimilar semiconductors.

a) Phototransistor b) Heterojunction

c) Schottky diode d) PIN diode

(8) The behaviour of a semiconductor junction depends crucially on the _____ at the interface.

a) Pressure b) Temperature

c) Humidity d) Alignment of the energy bands

(9) When two different semiconductors form a heterojunction, a quantum well can be fabricated due to the difference in _____.

a) Band structure b) Bandgap

c) Electron affinity d) Ionisation potential

(10) The MOS structure is treated as a _____.

a) Parallel connection of two capacitors b) Series connection of two capacitors

c) Series connection of three capacitors d) Parallel connection of three capacitors

(11) _____ circuitry dissipates less power than logic families with resistive loads

a) Rectifier b) MOS

c) CMOS d) Amplifier

(12) _____ logic gates are manufactured using the combination of NMOS and PMOS field-effect transistors

a) BJT b) FET

c) MOS d) CMOS

Q.2 Attempt **any eight** of the following. **(16)**

(1) Explain the effective mass concept.

(2) Write on the velocity of electrons according to band theory.

(3) Explain Bloch theorem briefly.

(4) Give distinction between metals, insulators and semiconductors.

(5) Write on the density of states in the energy band.

(6) What do you mean by amorphous semiconductor?

(7) Explain rectifying and ohmic contacts.

(8) What is depletion inversion?

(9) Explain *DC* transfer characteristics.

(10) Explain the concept of junction leakage.

Q. 3 (A) Explain Brillouin zones in detail. **(08)**

OR

Q. 3 (B) Explain the Kronig-Penney model. **(08)**

Q. 4 (A) Write a detailed note on the Hall effect with the necessary diagram. **(08)**

OR

Q. 4 (B) Explain the concept of Fermi level in detail with necessary diagrams. **(08)**

Q. 5 (A) Give an account of barrier height. **(08)**

OR

Q. 5 (B) What is heterojunction? How does it differ from the Schottky junction? Explain heterojunction with necessary band diagrams. **(08)**

Q. 6 (A) Write a detailed not on capacitance-voltage (*C-V*) characterisation with the necessary diagram. **(08)**

OR

Q. 6 (B) Discuss the MOS gate capacitance model in detail. **(08)**

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Seat No. _____ Enrolment No. _____

THE CHARUTAR VIDYA MANDAL UNIVERSITY

M. Sc. PHYSICS – SEMESTER 3

WINTER 2021 EXAMINATION

Course Title: Digital Communication

Course Code: 101510302

Total Printed Pages : 2

Date: 17/11/2021 **Time: 10:00 am to 12:00 am** **Maximum Marks: 60**

Instructions:

- Attempt all questions.
- Numbers to the right indicate full marks for each question.
- Make suitable assumptions wherever necessary.

Q. 1 Answer the following multiple choice questions. **(12)**

(1) Advantage of Digital system is
(a) more bandwidth required (c) time synchronization needed
(b) incompatible with old system (d) noise immunity

(2) In synchronous transmission frame format actual number of data bytes are included in
(a) error (b) data (c) control (d) sync bits

(3) Which Data compression technique is used for Fax transmission?
(a) Run length (b) Huffman Code (c) Relative encoding (d) Ziv

(4) Currents that flow in opposite directions in a balanced wire pair called as
(a) Longitudinal circuit (c) Metallic circuit
(b) Transverse circuit (d) Common circuit

(5) Basic Group of FDM hierarchy consists of ..... Channels.
(a) 10 (b) 3 (c) 5 (d) 12

(6) The ratio of minimum number of bits (including sign bit) to actual number of bits (including sign bit) is called as:
(a) dynamic range (c) quantization noise
(b) coding efficiency (d) step size

(7) A computer with specialized hardware and operating system designed for forwarding packets.
(a) Hub (b) Gateway (c) Router (d) Repeater

(8) Mathematical expression for success rate measured in Slotted Aloha is
(a) $S = Ge^{-G}$ (b) $S = Ge^{-2G}$ (c) $S = Ge^{G}$ (d) all

(9) Claim token in Token Bus protocol is represented by
(a) 00000000 (b) 00000010 (c) 00000100 (d) 10101010

(10) The sequence of ending delimiter in frame format of token ring is
(a) JK1JK1IE (b) JK0JK000 (c) JKJKJK00 (d) JK0JK1IE

(11) ..... is part of the Open Standard IEC 61158.
(a) Devicenet (b) Modbus (c) CAN (d) Profibus

(12) THT in Token Bus stands for
(a) Token Holding Timer (c) Time Holding Terminal
(b) Token Hollow Timer (d) Time Hot Terminal

Q.2 Attempt **any eight** of the following. **(16)**

(1) A digital signal has a bit rate of 10Kbps. What is the duration of each bit? What is the sampling rate needed for signal with a bandwidth of 12000 Hz in the range of 10000 Hz to 15000 Hz?
(2) Draw neat block diagram of PCM-TDM.
(3) Enlist types of Content error and Error detection methods.
(4) Define Gateway. List its benefits.
(5) Write advantages and disadvantages of Repeater.
(6) Draw pin connection diagram of Null Modem.
(7) Write the functions of Presentation layer.
(8) List different LAN Topologies and write advantages.
(9) Classify Multiple Access Protocols.
(10) Enlist Device Net Components.

Q. 3 What is Phase Shift Keying? Explain Binary Phase Shift Keying. **(08)**

OR

Q.3 What do you understand by Compression? Discuss Huffman Code and Relative encoding techniques with suitable example. **(08)**

Q. 4 Explain Super Frame format of Time Division Multiplexing system. **(08)**

OR

Q. 4 Write a short note on Hub with its limitations. **(08)**

Q. 5 What is the advantage OSI model? Discuss functions of each layer. **(08)**

OR

Q. 5 Explain IEEE -Token Bus standard in length. **(08)**

Q. 6 What is Field bus? List its features, requirements and advantages-disadvantages. **(08)**

OR

Q. 6 Write a short note on Profibus. **(08)**

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Seat No. _____ Enrollment No. _____

THE CHARUTAR VIDYA MANDAL UNIVERSITY

Master of Science (Physics) – SEMESTER 3

WINTER 2021 EXAMINATION

Course Title: Electrodynamics and Antenna

Course Code: *101510312*

Total Printed Pages: 02

Date: 18/11/2021 (Thursday) **Time: 10.00 am to 12.00 pm** **Maximum Marks: 60**

Instructions:

- Attempt all questions.
- Numbers to the right indicate full marks for each question.
- Make suitable assumptions wherever necessary.

Q. 1 **Answer the following multiple choice questions.** **(12)**

(1) Gauss's law in differential form is written as-

(A) $\nabla . \boldsymbol{E} = \frac{\rho}{\epsilon_0}$ (B) $\nabla . \boldsymbol{B} = \frac{\rho}{\epsilon_0}$

(C) $\nabla . \boldsymbol{E} = \frac{J}{\epsilon_0}$ (D) $\nabla . \boldsymbol{B} = \frac{J}{\epsilon_0}$

(2) Ampere's circuital law is-

(A) $\int \boldsymbol{B}.dl = \mu_0 E$ (B) $\int \boldsymbol{B}.dl = \mu_0 I$

(C) $\int \boldsymbol{E}.dl = \mu_0 E$ (D) $\int \boldsymbol{E}.dl = \mu_0 I$

(3) Laplace equation is given by-

(A) $\nabla^2 f = 0$ (B) $\Delta^2 f = 0$

(C) $\nabla^2 \phi = \sigma(x)$ (D) both A and B

(4) Transmission lines especially applies to.....

(A) radio frequency (B) microwaves frequency

(C) infrared frequency (D) visible light frequency

(5) The ordinary cables cannot carry the currents above .....

(A) 30kHz (B) 20kHz

(C) 30 Hz (D) 20 Hz

(6) Twisted pair cables are used to improve the ..... compatibility

(A) electromagnetic (B) transmission

(C) absorption (D) Attenuation

(7) The parallel transmission line is employed where ..... Properties are required

(A) Balance (B) imbalance

(C) high frequency (D) none of these

(8) In transmission line input impedance depends on ....

(A) type of line (B) length

(C) termination at far end (D) All of these

(9) What is the minimum value that the characteristic impedance of an air dielectric parallel wire line could have?

(A) 83 Ω (B) 166 Ω

(C) 41 Ω (D) 200 Ω

(10) A system carrying electromagnetic waves could be called .....

(A) waveguide (B) transmission line

(C) optical fibre (D) electrical cable

(11) The conduction of energy in waveguide is through

(A) walls (B) dielectric

(C) medium not required (D) conductors

(12) The circular waveguide is similar with

(A) coaxial line (B) fibre line

(C) electric line (D) all of the above

Q.2 Attempt **any eight** of the following. **(16)**

(1) Brief the Biot and Savart Law.
(2) Brief Poynting theorem
(3) Write the Maxwell's equations in differential form.
(4) Brief the stripline.
(5) Explain the standing waves in brief.
(6) Define reflection coefficient.
(7) What are wave guides?
(8) What are circulators?
(9) Brief the radiation mechanism.
(10) Give a brief note on elementary doublet.

Q. 3 Give a detail note on Maxwell's equations. Explain the physical significance in detail. **(08)**

OR

Q.3 Give a detail note on energy density in presence of magnetic field. **(08)**

Q. 4 What are transmission lines? Explain the quarter and half wavelength lines in detail. **(08)**

OR

Q. 4 Explain the basic principle and characteristic impedance of transmission lines **(08)**

Q. 5 What is circular waveguide? Explain in detail with advantages and disadvantages. **(08)**

OR

Q. 5 Give a detail note on waveguide coupling with its types. **(08)**

Q. 6 Explain the term Resonant antennas, radiation patterns, and length calculations for Antennas. **(08)**

OR

Q. 6 Discuss the characteristics of various high-frequency antenna system. **(08)**

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Seat No. _____ Enrollment No. _____

THE CHARUTAR VIDYA MANDAL UNIVERSITY

M.Sc. PHYSICS – SEMESTER 3

WINTER 2021 EXAMINATION

Course Title: Microwave & Satellite Communication

Course Code: 101510313

Total Printed Pages : 2

Date: 19/11/2021 **Time: 10.00 am to 12.00 pm** **Maximum Marks: 60**

Instructions:

- Attempt all questions.
- Numbers to the right indicate full marks for each question.
- Make suitable assumptions wherever necessary.

Q. 1 Answer the following multiple choice questions. **(12)**

(1) _____diversity is generally used in conjunction with space diversity
   a) Frequency b) Time c) Space d) Polarization

(2) The radar in which both transmission and reception is done using the same antenna are called:
   a) Monostatic radar b) Bistatic radar c) Monopole radar d) Dipole radar

(3) Input Noise power of receiver for 10MHz Noise bandwidth is
   a) -104 dB b) -104 dBm c) -14 dB d) -14 dBm

(4) The down link frequency in the C band transponder is
   a) 6 GHz b) 4 GHz c) 12 GHz d) 8 GHz

(5) Define Polar-orbiting Satellites.
   a) Polar orbiting Satellites orbit the earth in such a way as to cover the north & south Polar Regions.
   b) Orbiting Satellites orbit the earth in such a way as to cover the east & west Polar Regions
   c) Both of these
   d) None of the above

(6) Determine the carrier-to-noise density ratio for a receiver with a 70-dBW input carrier power, an equivalent noise temperature of 180 K, and a bandwidth of 20 MHz
   a) 13.605 dB b) 1.3605 dB c) 136.05 dB d) 1360.5 dB

(7) To make antenna more directional, either its size must be increased or
   a) the number of its feed horns must be increased
   b) its effective isotropic radiated power (EIRP) must be increased
   c) its footprint must be increased
   d) the frequency of its transmission must be increased

(8) Which of the following is not a satellite subsystem?
   a) Ground station b) Power system c) Telemetry tracking d) Communication subsystem

(9) The primary electrical power for operating the electronic equipment in satellite is obtained from
   a) The payload refers to the equipment used to pro-vide the service for which the satellite has been launched.
   b) The bus refers not only to the vehicle which carries the payload.

c) solar cells
d) none of the above

(10) What are the limitations of FDMA-satellite access?
a) Compared with TDMA, FDMA has less flexibility in reassigning channels.
b) If the traffic in the downlink is much heavier than that in the uplink, then FDMA is relatively inefficient.
c) Carrier frequency assignments are hardware controlled
d) all of the above

(11) Which of the following is the first component of any MATV system to receive broadcast signals?
a) Filter b) Antenna c) LNA d) RF amplifier

(12) Is the most common technique where apartment house, hotels, schools, condominiums, and multi-unit buildings distribute TV and FM signals to a number of receivers, using a single head-end.
a) Indoor unit b) Outdoor Unit c) TV unit d) None of these

Q.2 Attempt **any eight** of the following. **(16)**

(1) Write Advantage of Microwave Radio System.
(2) Describe the baseband signal for a microwave system.
(3) Write Applications of Microwave Radio System.
(4) List out advantages and disadvantages of geosynchronous satellites.
(5) Define satellite spatial separation and list its restrictions.
(6) Define prograde and retrograde.
(7) What are a Yaw, Pitch and Raw axis?
(8) What is meant by redundant receiver?
(9) Draw Block diagram of MATV
(10) Describe TDMA.

Q. 3 Derive Radar Range equations. **(08)**

OR

Q.3 Describe a microwave repeater. Contrast baseband and IF repeaters. **(08)**

Q. 4 Explain SATELLITE SYSTEM LINK MODELS. **(08)**

OR

Q. 4 a) For an earth station transmitter with an antenna output power of 40 dBW (10,000 W), a back-off loss of 3 dB, a total branching and feeder loss of 3 dB, and a transmit antenna gain of 40 dB, determine the EIRP. **(04)**

b) An earth station satellite transmitter has an HPA with a rated saturated output power of 10,000 W. The back-off ratio is 6 dB, the branching loss is 2 dB, the feeder loss is 4 dB, and the antenna gain is 40 dB. Determine the actual radiated power and the EIRP. **(04)**

Q. 5 Explain TT&C system **(08)**

OR

Q. 5 Describe Momentum wheel stabilization. **(08)**

Q. 6 What is Multiple Access? Explain FDMA & CDMA. **(08)**

OR

Q. 6 Write a short note on CATV. **(08)**

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