Seat No. _____ Enrolment No. _____

THE CHARUTAR VIDYA MANDAL UNIVERSITY

M. Sc. INSTRUMENTATION AND CONTROL – SEMESTER 3

WINTER 2021 EXAMINATION

Course Title: Biomedical Instrumentation

Course Code: 101390301

Total Printed Pages : 02

Date: 16/11/2021 **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) The implantable electrode system is an example of .....

(a) invasive sensor (c) non invasive sensor

(b) remote sensor (d) all

(2) Bioelectric potential is generated at ..... level and the source of potential is ..... in nature.

(a) skin, resistive (c) tissue, electronic

(b) cellular, ionic (d) none

(3) The process of graphical recording of heart sounds or murmurs is....

(a) Electrocardiograph (c) Electromyogram

(b) Electroencephalograph (d) Phonocardiograph

(4) Instruments used to detect arterial pulse and pulse pressure waveform is....

(a) Encephalograph (c) Plethysmograph

(b) Sphygmomanometer (d) Rheograph

(5) Extra vascular and Intravascular methods are types of ....

(a) Patient monitoring (c) Electrodermal activity

(b) Direct blood pressure (d) Heart rate measurement

(6) It is derived by the amplification of the ECG signal & measuring either the average or instantaneous time intervals between two successive R peaks.

(a) Patient monitoring (c) Plethysmographic signal

(b) Heart Rate (d) Both a & b

(7) In Arrythmia monitoring .....has important role.

(a) Temperature (c) blood flow

(b) QRS detection (d) MRI

(8) Which one is not suitable as precautions to record FECG?

(a) Signal to noise ratio be kept high

(b) Low electrode skin contact impedance

(c) Equipment properly grounded

(d) Patient electrically not isolated from the equipment

(9) .....is the measurement of biological parameters over distance, and transmitting the data from point of generation to the point of reception.

(a) Cardiotocography (c) Pluse Oxymetry

(b) Ultrasound technique (d) Biotelemetry

(10) ..... is used to measure the pH, pCO_2 and pO_2 of the body fluids with

special reference to the human blood.

(a) ECG (c) Blood Gas Analyzer

(b) Pulse Oxymeter (d) Cardiotocogrpahy

(11) ..... refers to the determination of the percentage of oxygen saturation of the circulating arterial blood.

(a) Pulmonary meter (c) EMG

(b) Oximetry (d) Spirometer

(12) Dielectric Withstand Test performed in electrical production industry is also called as:

(a) Audiometer (c) pO_2 meter

(b) pH meter (d) Hipot

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

(1) Draw neat labelled block diagram of Medical Instrumentation System.

(2) Enlist the pairs of Einthoven leads.

(3) How skin contact impedance is measured?

(4) Explain briefly Reflectance method for blood volume change.

(5) Write the equation for Ultrasonic Doppler shift and interpret all terms.

(6) List major sources of noise in foetal ECG signals.

(7) How electronic foetal monitoring is performed?

(8) List advantages of pulse oxymeter.

(9) Define terms:
Tidal Volume, Alveor Ventilation, Vital capacity and Dead space.

(10) List the functions of Pulmonary function analyzer.

Q. 3 Explain with neat figures, generation of Bioelectric signals in human body. **(08)**

OR

Q.3 Write a note on EEG. **(08)**

Q. 4 Explain automatic blood pressure measurement using Kortkoff's method. **(08)**

OR

Q. 4 Draw block diagram of Cardiotachometer and explain function of each component. **(08)**

Q. 5 What are components of Biotelemetry? Explain implantable telemetry system. **(08)**

OR

Q. 5 With neat block diagram explain Ambulatory monitoring Instruments. **(08)**

Q. 6 Write a note on patient safety with advantages of leakage current measurement and mention preventive steps and testing of medical equipment. **(08)**

OR

Q. 6 Explain principle of Spirometer and discuss its types briefly. **(08)**

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Seat No. _____ Enrolment No. _____

THE CHARUTAR VIDYA MANDAL UNIVERSITY

M. Sc. INSTRUMENTATION AND CONTROL – SEMESTER 3

WINTER 2021 EXAMINATION

Course Title: Industrial Communication Techniques

Course Code: 101390302

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) The best Line encoding format for error detection is
(a) UPNRZ (b) BPRZ (c) BPRZ- AMI (d) UPRZ

(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) What is the bandwidth of Super Group?
(a) 48 KHz (b) 240 KHz (c) 2728 KHz (d) 2520 KHz

(5) According to Nyquist theorem, minimum sampling rate is equal to.....
(a) 3 times of the highest audio frequency
(b) 1/2 of the highest modulating frequency
(c) 1/4 of the highest audio frequency
(d) 2 times of the highest modulating frequency

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

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

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

(11) CAN 2.0B is ..... bus.
(a) two wire (b) bidirectional (c) high speed (d) all listed features

(12) 8000-MTCP System Application model is found in.....
(a) Devicenet (b) Modbus (c) CAN (d) Profibus

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

(1) Enlist types of Content error and Error detection methods.
(2) Show with diagram traffic types handle by Hub.
(3) A digital signal has a bit rate of 20Kbps. What is the duration of each bit? What is the sampling rate needed for signal with a bandwidth of 10000 Hz in the range of 10000 Hz to 11000 Hz?
(4) Define Gateway. List its benefits.
(5) Write advantages and disadvantages of Repeater.
(6) For a voice band channel of 4KHz in FDM hierarchy what will be the channel carrier frequency for 10^{th} group and output frequency at low pass filter?
(7) Write the functions of Session layer.
(8) Draw neat figures of LAN Topologies.
(9) Classify Multiple Access Protocols.
(10) Enlist Device Net Components.

Q. 3 Determine the Block Check Sequence for the following data and CRC generating polynomial. **(08)**
Data, $G(x) = x^7 + x^5 + x^4 + x^2 + x^1 + x^0$ and CRC, $P(x) = x^5 + x^4 + x^1 + x^0$
Verify it at receiver end for any error.

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 Describe HART and list its advantages. **(08)**

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

OR

Q. 5 Explain 802.3 Ethernet protocol with its Frame Format. Consider 802.3 LAN with 500 stations connected to a FIVE 500-meter segments. The data rate is 10Mbps and the slot time is 51.2 μsec. If all stations transmit with equal probability what is the channel utilization using a frame size of 512 bytes? **(08)**

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

OR

Q. 6 Write a note on Controiler Area Network protocol. **(08)**

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Seat No. _____ Enrollment No. _____

THE CHARUTAR VIDYA MANDAL UNIVERSITY

<M.Sc.(Inst & Ctrl)> – SEMESTER 3

WINTER 2021 EXAMINATION

Course Title: PLC-DCS-SCADA

Course Code: 101390303

Total Printed Pages : 04

Date:18/11/2021 **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 PLC was invented to replace

(i) Microprocessors (ii) Hard wire relay control
(iii) Digital controllers (iv) None of the above

(2) In the PLC based control system, the location of a specific input or output device is identified by its

(i) Power rating (ii) Current rating (iii) Address (iv) Voltage rating

(3) Which of the given devices can be used as switching device in a discrete DC output card of PLC?

(i) DIAC (ii) SCR (iii) TRIAC (iv) LED

(4) The advantage of using remote I/O connections in PLC base control systems is

(i) Ease of programming (ii) Reduction in cost of wiring/cabeling
(iii) Speed of operation (iv) Ease of fault finding

(5) During the idle time (referred to scan time), the PLC will do

(i) Input Scan (ii) Output Scan (iii) Nothing (iv) Program Execution

(6) In a PLC based control system, an output fails to turn on even though the output LED at PLC is on. The voltage at the PLC output is tested and is found normal, but the voltage at the output device is found to be absent. The fault in the system is:

(i) Faulty wiring (ii) Fault in PLC
(iii) Fault in program (iv) Fault in output device

(7) What is the full name of HMI?

(i) Hand machine interface (ii) Human machine interface
(iii) Hard machine interface (iv) Heart machine interface

(8) In distributed system, each processor has its own _____

(i) Local memory (ii) Clock
(iii) both local memory and clock (iv) None of the above

(9) Processes on the remote systems are identified by _____

(i) Host ID (ii) Host name and identifier (iii) Identifier (iv) Process ID

(10) In a serial communication transmission system, how many bits can be transmitted and received at a time?

(i) Eight bits (ii) One bit (iii) Sixteen bits (iv) Four bits

(11) Which routing technique is used in a distributed system?

(i) Fixed routing (ii) Virtual routing
(iii) Dynamic routing (iv) None of the above

(12) The SCADA system performs _____

(i) Data presentation (ii) Data acquisition
(iii) Networked data communication (iv) All of the above

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

(1) Explain remote I/O for PLC.
(2) Explain concept of sourcing and sinking.
(3) List any four devices which can be connected as input devices to PLC and show the wiring/connections of these devices with PLC.
(4) Explain need of optical- isolator in PLC I/O card.
(5) Draw FBD program for two inputs EX-NOR gate.
(6) Draw ladder diagram for the following Boolean expression.

$$X=(A+B)(C+D) + AE$$

Where, X is digital output, A, B, C, D and E are digital inputs.
(7) Give the list various alarm check functions in DCS.
(8) Explain differences between DCS and SCADA.
(9) Explain why SCADA is called 'limited two-way' system.
(10) Explain full duplex communication systems.

Q. 3 Give list of various programming languages available to program PLCs. Also explain various rules of designing ladder diagram with suitable programming example. **(08)**

OR

Q.3 Draw PLC FBD program from the ladder diagram given below in figure 1. **(04)**

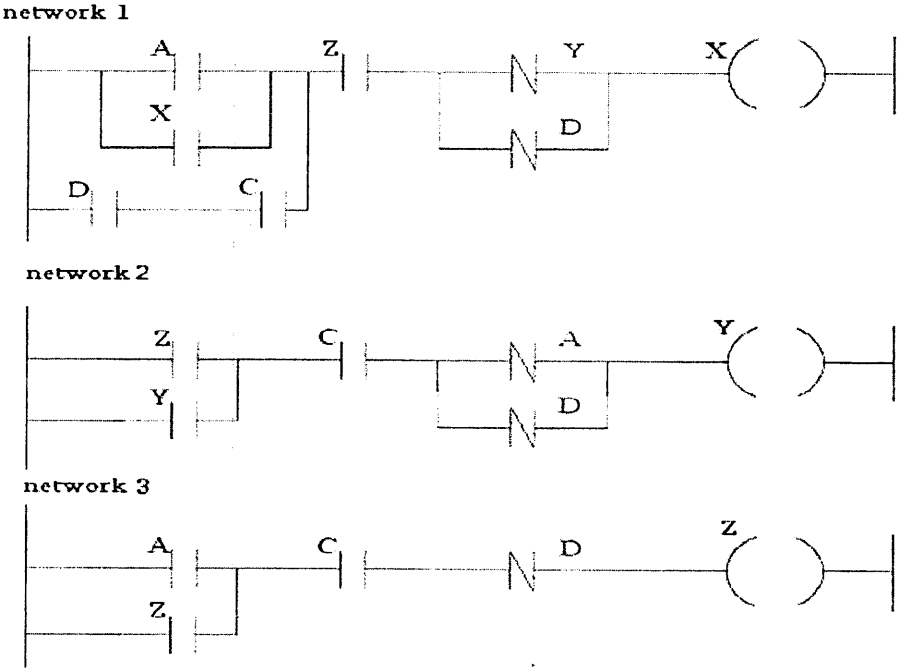

Figure 1

Three conveyors feed parts to main conveyor. Construct a ladder diagram to obtain the total count of parts on the main conveyor. The count of parts on the main conveyor should be updated only after each 15 seconds. **(04)**

Q. 4 A conveyor belt is having a 'NC' photo sensor at both ends which will sense the objects entering and leaving the conveyor belt. When conveyor runs in forward direction, objects will enter on the conveyor from END 1 and leave from END 2. If number of objects on the conveyor is less than 5, conveyor will continue running in the forward direction, and if more than 4, conveyor will stop running in forward direction and after 10 seconds, conveyor will run in the reverse direction so that objects can leave the conveyor from END 1. When once again, the number of objects on the conveyor becomes less than 5, it will start running in forward direction. Objects can enter on conveyor only from END 1. A 'NO' START pushbutton will make the conveyor belt running and a 'NC' STOP pushbutton will make the conveyor belt permanently stopped. Design and draw PLC ladder logic diagram to control the given system. **(08)**

OR

Q. 4 (a) Enlist different counter instructions used in PLC programming and explain any one of them in detail. **(04)**

(b) Design and draw PLC ladder diagram to generate square wave at any digital output terminal with duty cycle of 70% and time period of 10 seconds when toggle switch is ON. If toggle switch is made OFF, there should be no output at that digital output terminal. **(04)**

Q. 5 Using suitable diagram, explain the structure of DCS in details. **(08)**

OR

Q. 5 What is Field Monitoring Station in DCS? List and explain various functions of Filed Monitoring Station of DCS. **(08)**

Q. 6 In SCADA systems, explain RTU with suitable block diagrams. Also explain various incoming and outgoing signals at and from RTU. **(08)**

OR

Q. 6 Using suitable diagrams, explain OSI model for communication used in SCADA systems. **(08)**

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Seat No. _____ Enrollment No. _____

THE CHARUTAR VIDYA MANDAL UNIVERSITY

M.Sc. INSTRUMENTATION & CONTROL – SEMESTER 3

WINTER 2021 EXAMINATION

Course Title: Satcom Instrumentation

Course Code: 101390307

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) What are the functions of IF Repeaters?
   a) Evaluating the carrier to noise ratio c) Both of above
   b) Simply measuring the received carrier power d) none of above

(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 these

(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 Draw and explain FM microwave Radio Transmitter. **(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 Complete the following Uplink budget: Find Uplink C/N. **(08)**

Up link Parameters

- 1. Earth station transmitter output power at saturation, 1 kW
- 2. Earth station back-off loss, 3 dB
- 3. Earth station total branching and feeder losses, 3 dB
- 4. Earth station transmit antenna gain for a 10-m parabolic dish at 14 GHz
- 5. Free-space path loss for 14 GHz
- 6. Additional uplink losses due to the Earth's atmosphere, 0.8 dB
- 7. Satellite transponder *G/Te, 4.6 dB/K*
- 8. Transmission bit rate, 90 Mbps, 8-PSK

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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