SLR-IB-1

Seat No.	

Set P

M.Sc. (Semester - I) (New) (NEP CBCS) Examination: March/April-2024
ELECTRONICS (IOT)
Hardware, Programming and IDE tools- AVR & PIC Series (2315101)

Day & Date: Friday, 10-05-2024 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

Instructions: 1) All questions are compulsory.
2) Draw neat diagrams and write equations wherever necessary.
3) Figures to the right indicate full marks.
4) Use of log-tables and calculator is allowed.
5) Use of Mobile is strictly prohibited.

Q.1 A) Choose the correct alternatives from the options. **08**

1) The number of assembly language instructions supported by PIC16C5x series is _____.
   a) 246 b) 33
   c) 64 d) 12

2) The ATmega32 AVR includes _____ multichannel ADC.
   a) 10 bit b) 12 bit
   c) 8 bit d) 16 bit

3) The C language instruction "TRISB=0x00;" will _____.
   a) Tristate al the pins of PORT-B
   b) Configure all the pins of PORT-B as input
   c) Configure all the pins of PORT-B as output
   d) Send the data 00H to PORT-B

4) The C language instruction "$\mathrm{DDRB} = \mathrm{DDRB}\ \&\ \sim(1 << 5);$" will _____.
   a) Configure PORT-B as an output port
   b) Configure PORT-B as input port
   c) Configure PB-5 pin of PORT-B as o/p
   d) Configure PB-5 pin of PORT-B as i/p

5) The X, Y and Z registers in ATmega32 series are used _____.
   a) As 16-bit address pointer for indirect addressing
   b) for 16-bit arithmetic operations
   c) as 16-bit stack pointer register for stack memory
   d) 16-bit Program counters

6) The number of general purpose registers in Bank-0 of PIC16C5x series microcontroller is _____.
   a) 8 b) 16
   c) 24 d) 32

7) The register used as address pointer for indirect addressing in PIC16C5x series microcontroller is _____.
   a) OPTION b) FSR
   c) STATUS d) TMR-0

8) The total number of interrupts in ATmega328 as per the interrupt vector table are _____.
   a) 08 b) 12
   c) 15 d) 26

B) Fill in the blanks or Write true/false. **04**

1) The maximum operating frequency of PIC16C5x series microcontroller is _____ MHz.
2) ATmega328 microcontroller Watch Dog Timer has a separate on-chip oscillator of _____ KHz.
3) The register used to set the baud rate of serial communication in ATmega32 is called UBRR (true/false).
4) The 8-bit Timer/Counter register used in PIC16C5x series microcontroller is named as OPTION register, (true/false).

Q.2 Answer the following. (any six - two marks each) **12**

a) Enlist the family members of AVR microcontroller family.
b) Enlist the family members of PIC family.
c) What are the different features of MPLAB IDE software?
d) List any four features of ATMEL/Microchip Studio.
e) Explain the need of prescalar in timers.
f) Explain the role of INDF register in PIC16C5x series microcontroller.
g) Write the C instructions to configure PORT-D as input port and read the data from PORT-D.
h) Write the C instructions to logically AND the values 25H and 81H for PIC series.

Q.3 Answer the following.(any three - four marks each) **12**

a) Explain the STATUS register of PIC16C5x series microcontroller.
b) Write a C program for AVR ATmega32 series to read the data from PORT-B and PORT-C, add the data and send the result to PORT-D.
c) Draw the equivalent circuit for a single I/O port pin of PIC16C5x series and explain.
d) Write a short note on Instruction execution timing and pipe-lining for AVR ATmeg32.

Q.4 Answer the following. (any two - six marks each) **12**

a) Explain the 28-pin distribution for PIC16C5x microcontroller.

b) Explain the architectural block diagram of ATmega32 series.

c) Write a note on IDE tools MPLAB for PIC series of microcontroller.

Q.5 Answer the following.(any two - six marks each) **12**

a) Write a C language program for ATmega32 series to convert hexadecimal number 45H into decimal number and send the result on PORT-C.

b) Write a C language program for PIC16C5x series microcontroller to generate a square wave of 1-KHz on port pin PB-4 using timer and assuming a crystal frequency of 20 MHz.

c) Discuss the flash memory program programming steps for ATmega32 or PIC series of microcontroller using any programming IDE.

SLR-IB-2

Seat No.	

Set P

M.Sc. (Semester - I) (New) (NEP CBCS) Examination: March/April - 2024
ELECTRONICS (IOT)
Sensors and Actuators (2315102)

Day & Date: Monday, 13-05-2024 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

Instructions: 1) All question are compulsory.
2) Draw neat diagram and write equations wherever necessary.
3) Figure to right indicate full marks.
4) Use of log table and calculator is allowed.
5) Use of Mobile is strictly prohibited.

Q.1 A) Choose correct alternative. **08**

1) Which one of these is a humidity sensor?
   a) Hygrometer b) Gyroscope
   c) Seismoscope d) Sundial

2) Which one of the following devices can be used for displacement measurement?
   a) LVDT b) Bellows
   c) Capsule d) Bourdon tube

3) Barometer is _____ type of sensor.
   a) Touch b) Pressure
   c) Temperature d) Humidity

4) Photo resists film is exposed to _____ rays for transferring patterns.
   a) Cosmic rays b) UV rays
   c) IR rays 152 d) None of the above

5) The process of dipping substrate into chemical solution that selectively removes material is called _____.
   a) Wet etching b) Dry etching
   c) Gas etching d) None of the above

6) In LVDT, the two secondary voltages _____.
   a) Are independent of the core position
   b) Vary unequally depending on the core position
   c) Vary equally depending on the core position
   d) Are always in phase quadrature

7) Standard pressure range of piezoelectric sensor is _____.
   a) 4 to 20 MA b) 0.2 to 1.0 bar
   c) 3 to 15 psi d) All the above

8) Which of the following device can be used for displacement measurement?
   a) LVDT b) Bellows
   c) Capsule d) Bourdon tube

B) Fill in the blanks Or True/False. **04**

1) Capacitor microphone works on the principle of Active transducer. (True/False)
2) Gyroscope measures directly the value of humidity present in the surrounding environment. (True/False)
3) The difference between actual value and the true value of the quantity being measured is _____.
4) All actuators are part of Transducers. (True/False)

Q.2 Answer the following. (Any Six) **12**

a) What is backlash?
b) Give working principle of stepper motor.
c) What is difference between NTC and PTC thermistor?
d) What is Transducer? Give one advantage of Transducer.
e) What is micro sensor? Give one example.
f) Explain Piezoelectric plastics.
g) Distinguish between static and dynamic characteristics.
h) Explain principle of operation of Potentiometric Transducer.

Q.3 Answer the following. (Any Three) **12**

a) Write basic steps of LIGA process.
b) Explain in the brief selection criteria of Actuators.
c) Write working principle of DC motor and give its types.
d) Explain Capacitive Pressure sensor briefly.

Q.4 Answer the following. (Any Two) **12**

a) Discuss the working of Hot wire Anemometer.
b) Draw the schematic design of a micro biosensor and explain. Draw the sensor response curve and explain.
c) Explain the Construction and working of piezoelectric actuators.

Q.5 Answer the following. (Any Two) **12**

a) Describe the construction of LVDT and explain its principle of operation with the aid of diagram. List the advantages, disadvantages and applications of LVDT.
b) Discuss Sensor materials Ceramics and Glasses.
c) Explain the construction, principle of operation, circuit and applications of Servo motor.

SLR-IB-3

Seat No.	

Set P

M.Sc. (Semester - I) (New) (NEP CBCS) Examination: March/April-2024
ELECTRONICS (IOT)
Programming with C and C++ (2315107)

Day & Date: Wednesday, 15-05-2024 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

Instructions: 1) All questions are compulsory.
2) Draw neat diagrams and write equations wherever necessary.
3) Figures to the right indicate full marks.
4) Use of log-table and calculator is allowed.
5) Use of Mobile is strictly prohibited.

Q.1 A) Choose the correct alternatives. **08**

1) Which of the following is a valid way to declare a pointer in C?
   a) int* ptr; b) pointer ptr;
   c) ptrint; d) *intptr;

2) Which header file must be included to use the 'printf' and 'scanf' functions in C?
   a) stdlib.h b) math.h
   c) stdio.h d) string.h

3) What does the 'strcmp' function do in C?
   a) Compares two strings b) Copies one string to another
   c) Concatenates two strings d) Converts a string to uppercase

4) Which bitwise operator is used to set a particular bit to 1 in C?
   a) & b) |
   c) ^ d) ~

5) Which of the following is the correct way to declare a 2D array in C?
   a) intarr[3][3]; b) intarr[3, 3];
   c) intarr[3 * 3]; d) . intarr[3][3]();

6) Which C++ feature is used to achieve function overloading?
   a) Overwrite b) Overload
   c) Overfunction d) None of the above

7) What is the purpose of the 'static' keyword in a C++ class?
   a) Declares a static variable
   b) Allocates dynamic memory
   c) Defines a constant
   d) Specifies a static member of a class

8) Which standard library header file is used for string manipulation in C++?
   a) string.h b) strutil.h
   c) Cstring d) sstream

B) State True or False. **04**

1) Double is not a valid C++ data type.
2) Declares a constant variable is the purpose of the 'const' keyword in C++.
3) The 'scanf' function Reads formatted input in C.
4) *Operator is used to access the value stored in a pointer variable in C.

Q.2 Answer the following. (Any Six) **12**

a) Explain the difference between == and = operators in C.
b) What is the purpose of the continue statement in C?
c) How can you open a file in C? Provide an example.
d) Explain the concept of dynamic memory allocation in C.
e) Describe the purpose of the virtual keyword in C++.
f) What is polymorphism in C++? Provide an example.
g) Explain the purpose of the const keyword in C++.
h) Describe the use of the friend keyword in C++.

Q.3 Answer the following. (Any Three) **12**

a) Explain the concept of a pointer in C. Provide examples demonstrating the declaration and initialization of pointers.
b) Describe the importance of the "auto" keyword in C++11 onwards. Provide an example demonstrating its usage.
c) Define the term "token" in C++. Provide examples of different types of tokens.
d) Explain the role of member functions in C++ classes. Provide examples demonstrating the use of member functions.

Q.4 Answer the following. (Any Two) **12**

a) Explain the concept of function pointers in C. Provide examples illustrating how function pointers are declared and used in C programming.
b) Illustrate the use of templates in C++. Explain how template functions and classes work, providing examples for both.
c) Describe the concept of multiple inheritance in C++. Provide examples demonstrating its implementation and potential challenges.

Q.5 Answer the following. (Any Two) **12**

a) Explain the purpose and implementation of file handling in C. Provide examples demonstrating how to read from and write to files, both in text and binary modes.
b) Compare and contrast arrays and linked lists in C. Explain the advantages and disadvantages of each data structure, providing examples to support your discussion.
c) Explain the concept of exception handling in C++. Provide examples demonstrating the use of try, catch, and throw blocks. Discuss the advantages of using exception handling.

SLR-IB-7

Seat No.	

Set P

M.Sc. (Semester - I) (New) (NEP CBCS) Examination: March/April -2024
ELECTRONICS (IOT)
Research Methodology (2315103)

Day & Date: Friday, 17-05-2024 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

Instructions: 1) All questions are compulsory.
2) Draw neat diagrams and write equations wherever necessary.
3) Figures to the right indicate full marks.
4) Use of log-tables and calculator is allowed.
5) Use of Mobile is strictly prohibited.

Q.1 A) Multiple Choice Question **08**

1) What does a null hypothesis state in a research study?
   a) There is no relationship between variables
   b) There is a significant relationship between variables
   c) The research is inconclusive
   d) The sample is representative

2) What is the primary purpose of random sampling in research?
   a) To ensure convenience
   b) To obtain a representative sample
   c) To reduce sample size
   d) To establish causation

3) Which of the following is an example of a qualitative data type?
   a) Age b) Weight
   c) Gender d) Narrative responses

4) What is the purpose of a correlation study in research?
   a) To establish causation
   b) To compare means of two groups
   c) To examine relationships between variables
   d) To test the significance of a difference

5) In grounded theory research, what is the aim of data analysis?
   a) To identify patterns or themes
   b) To test hypotheses
   c) To conduct statistical tests
   d) To establish causation

6) What is the purpose of a conceptual framework in a research study?
   a) To summarize existing literature
   b) To provide a theoretical foundation
   c) To conduct statistical analyses
   d) To collect primary data

7) In qualitative research, what is the primary aim of member checking?
   a) To establish causation
   b) To ensure confidentiality
   c) To verify the accuracy of findings with participants
   d) To conduct statistical analyses

8) What does the term "reliability" refer to in research?
   a) The extent to which the study's results can be generalized
   b) The consistency and stability of measurement
   c) The statistical significance of findings
   d) The ethical considerations of the study

B) State true or false. **04**

1) A hypothesis is a tentative assumption made in order to draw out and test its logical or empirical consequences
2) Random sampling ensures that every member of the population has an equal chance of being selected.
3) Qualitative research is primarily concerned with numerical data analysis.
4) Validity refers to the degree to which a measurement tool accurately measures what it is intended to measure.

Q.2 Answer the following (Any Six) **12**

a) Define the term "descriptive statistics" in quantitative research.
b) Explain the purpose of a research hypothesis.
c) Define the term "external validity" in research.
d) Give the difference between open-ended and closed-ended questions.
e) Define the term "sampling error" in research.
f) Discuss the importance of peer review in the research publication process.
g) Discuss the purpose of a theoretical framework in a research study.
h) Explain the concept of snowball sampling.

Q.3 Answer the following (Any Three) **12**

a) Explain the concept of a research hypothesis and provide examples of how hypotheses guide the research process.
b) Describe the purpose of a literature review in research methodology. Provide examples of how a literature review contributes to the research process.
c) Discuss the importance of sampling techniques in research. Provide examples of different sampling methods and their applications.
d) Explain the concept of research variables. Provide examples of independent and dependent variables in a research study.

Q.4 Answer the following (Any Two) **12**

a) Discuss the significance of content analysis as a qualitative research method. Provide examples illustrating the application of content analysis in research.
b) Explain the purpose and process of conducting a pilot study in research. Provide examples of how a pilot study contributes to the research design.
c) Compare and contrast cross-sectional and longitudinal research designs. Provide examples of research questions suitable for each design.

Q.5 Answer the following (Any Two) **12**

a) Compare and contrast deductive and inductive approaches in research. Provide examples of research studies that follow each approach.
b) Discuss the significance of validity and reliability in research. Provide examples of how researchers can enhance the validity and reliability of their studies.
c) Explain the process of coding in qualitative data analysis. Provide examples of different coding techniques used in qualitative research.

SLR-IB-8

Seat No.	

Set P

M.Sc. (Semester - II) (New) (NEP CBCS) Examination: March/april-2024
ELECTRONICS (IOT)
Interfacing & Embedded System Design using – AVR & PIC Microcontrollers

Day & Date: Thursday, 09-05-2024 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

Instructions: 1) All Questions are Compulsory.
2) Figures to the right indicate full marks.
3) Draw neat diagrams and write equations wherever necessary.
4) Use of log-tables and calculator is allowed.
5) Use of Mobile is strictly prohibited.

Q.1 A) Multiple Choice Question **08**

1) What is the role of a compiler in embedded systems development?
   a) To convert high-level programming code into machine code
   b) To optimize the performance of embedded systems
   c) To debug software errors
   d) To design user interfaces

2) Which of the following memory types is typically used for storing program instructions in an embedded system?
   a) ROM (Read-Only Memory)
   b) RAM (Random Access Memory)
   c) EEPROM (Electrically Erasable Programmable Read-Only Memory)
   d) Flash memory

3) What is the role of the header file stdio.h in Embedded C programming?
   a) It includes functions for mathematical operations
   b) It includes functions for input and output operations
   c) It includes functions for string manipulation
   d) It includes functions for memory allocation

4) Which of the following is a common type of sensor used for measuring temperature?
   a) Thermocouple b) Accelerometer
   c) Photodiode d) Strain gauge

5) What is the purpose of signal conditioning in sensor applications?
   a) To amplify the sensor signal
   b) To filter noise from the sensor signal
   c) To convert the sensor signal to a usable form
   d) All of the above

6) Which of the following displays is commonly used for showing numeric digits and some alphabets?
   a) 7-segment display b) Dot matrix display
   c) LCD display d) OLED display

7) What type of relay uses a small amount of current to control a larger current?
   a) Electromechanical relay b) Solid-state relay
   c) Solenoid d) Optoisolator

8) What is the purpose of an RTC (Real-Time Clock) like DS1307 in embedded systems with a PIC microcontroller?
   a) To measure temperature
   b) To synchronize time-sensitive operations
   c) To control servo motors
   d) To generate PWM signals

B) State True/False. **04**

1) Both AVR and PIC microcontrollers typically use RISC (Reduced Instruction Set Computing) architecture.
2) AVR microcontrollers feature a wide range of built-in hardware peripherals, including ADC, PWM, and UART.
3) PIC microcontrollers often have a wide range of operating voltages, making them versatile for different applications.
4) The PIC microcontroller architecture utilizes a von Neumann architecture.

Q.2 Answer the following. (**Any Six**) **12**

a) What is the significance of the stack pointer register in embedded system programming?
b) What is the role of a watchdog timer in embedded systems?
c) What is the purpose of a CAN (Controller Area Network) bus in embedded systems?
d) Explain the concept of "bitwise operators" and their use in embedded C programming.
e) What is the function of an I2C (Inter-Integrated Circuit) bus in embedded systems?
f) Explain the importance of using #define macros in embedded C programming.
g) What is the purpose of the sizeof() operator in embedded C programming?

Q.3 Answer the following. (Any Three) **12**

a) Explain the matrix scanning technique commonly used in keyboard interfacing with AVR ATmega/ PIC microcontrollers. How does the microcontroller detect key presses in this configuration?
b) Explain how to implement relay switching logic using GPIO pins and software control on a microcontroller. Include examples.
c) Describe the hardware connections required for interfacing a 7-segment display with a AVR ATmega/ PIC microcontroller. How do you control individual segments?
d) Explain how to interface a light-dependent resistor (LDR) with an AVR ATmega/ PIC microcontroller for light sensing applications. Discuss any necessary signal conditioning measures.

Q.4 Answer the following. (Any Two) **12**

a) Discuss the different ADC channels available in AVR ATmega/ PIC microcontrollers. How can you select and configure specific ADC channels for multiple sensor interfacing?
b) Describe the hardware connections required for interfacing a DS1307 RTC module with a AVR ATmega/ PIC microcontroller. How do you ensure accurate timekeeping and data transmission?
c) Discuss the hardware connections required for interfacing a servo motor with a AVR ATmega/ PIC microcontroller. How do you control the motor's position and speed?

Q.5 Answer the following. (Any Two) **12**

a) Discuss the hardware connections required for interfacing an H-bridge driver with an AVR ATmega microcontroller. How do you control the DC motor's rotation and speed in Trade Mill Machine?

b) Explain the communication protocol used for interfacing LCD modules with AVR ATmega/ PIC microcontrollers. How does the microcontroller send commands and scrolling data on LCD in advertising Display?

c) Explain the principle of operation of a solenoid and its applications in Green House Automation with AVR ATmega / PIC microcontroller-based systems. How does the microcontroller control the solenoid actuation?

SLR-IB-9

Seat No.	

Set P

M.Sc. (Semester - II) (New) (NEP CBCS) Examination: March/April-2024
ELECTRONICS (IOT)
Fundamentals of Internet of Things

Day & Date: Saturday, 11-05-2024 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

Instructions: 1) All questions are compulsory.
2) Draw neat diagrams and write equations wherever necessary.
3) Figures to the right indicate full marks.
4) Use of log-tables and calculator is allowed.
5) Use of Mobile is strictly prohibited.

Q.1 A) Choose the correct alternatives from the options. **08**

1) Which of the following is not a function of IoT gateway?
   a) Switching b) routing
   c) protocol conversion d) noise generation

2) Which of the following protocols is used for real-time exchange of structured data?
   a) MQTT b) SMQTT
   c) XMPP d) CoAP

3) The objective of coverage in WSN is to use _____ number of sensors and _____ the network life time.
   a) minimum, maximize b) minimum, minimize
   c) maximum, minimize d) maximum, maximize

4) Which of the following issues need to be addressed while solving user interoperability?
   a) Device characterization and identification
   b) syntactic interoperability
   c) semantic interoperability
   d) All of these

5) During remote server access by Raspberry Pi, where Raspberry Pi acts as a client, the client needs the following.
   a) Only IP address of the server
   b) only port number
   c) only client IP address
   d) both server IP address and port number

6) Data security and client authentication is an issue in which of the cloud service models?
   a) SaaS b) SaaS and PaaS
   c) SaaS and IaaS d) All of these

7) Suppose that there are two LANs, each configured to be SDN enabled with their own set of switches and controller. Which among the following directional APIs will be used for communication between the two controllers?
   a) Northbound API b) East-Westbound API
   c) Southbound API d) North-Eastbound API

8) Which among the following is implemented along-with sensor cloud to make its services and performance better?
   a) cashing b) caching
   c) casing d) calling

B) Fill in the blanks or write True/False. **04**

1) Statement: The IEEE 802.15.4 is a well-known standard for low data rate Wireless Personal Area Network (WPAN). True or False
2) Full form of FANET is _____.
3) Statement: Raspberry Pi provides configuration options for camera. True or False
4) Statement: Sensor cloud is simply dumping and organizing of sensor data on cloud computing platform. True or False

Q.2 Answer the following. (Any Six) **12**

a) Define the term “Internet of Things”.
b) What are active and passive NFC devices?
c) What is Dumb node?
d) List the data types supported by Arduino Uno.
e) Name any four languages supported by Raspberry Pi.
f) What is software defined network?
g) Name the service models proposed in cloud computing.
h) What is Smart Grid?

Q.3 Answer the following. (Any Three) **12**

a) Write a note on different actuators used in IoT.
b) Explain IoT service oriented architecture.
c) Explain CoAP architecture and its Request-Response model
d) Draw the basic architecture of Raspberry Pi and discuss its specifications.

Q.4 Answer the following. (Any Two) **12**

a) Explain the interfacing of Humidity-Temperature sensor to Arduino Uno and write a program to display measured humidity and temperature on serial monitor using Arduino IDE.
b) Draw the SDN architecture and explain in detail.
c) With the help of layered diagram, explain different service models used in cloud SaaS, PaaS and IaaS.

Q.5 Answer the following. (Any Two) **12**

a) Explain various components required for Smart Home hence discuss Home Area Network (HANs).
b) Discuss various UAV network topologies.
c) Explain IEEE 802.15.4 communication protocol.

SLR-IB-10

Seat No.		Set	P

M.Sc. (Semester - II) (New) (CBCS) Examination: March/April-2024
ELECTRONICS (IOT)
Application Development using Arduino, NodeMCU & LORA

Day & Date: Tuesday, 14-05-2024 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

Instructions: 1) All questions are compulsory.
2) Draw neat diagrams and write equations wherever necessary.
3) Figure to right indicate full marks.
4) Use of log-tables and calculator is allowed.
5) Use of Mobile is strictly prohibited.

Q.1 A) Choose correct alternative. **08**

1) Which Arduino function is commonly used to interface with the SX1278 LORA module?
   a) analog Read() b) digital Read()
   c) LoRa.begin() d) Serial.begin()

2) Which sensor is commonly used to detect motion in Arduino applications?
   a) Temperature sensor b) PIR sensor
   c) Ultrasonic sensor d) Humidity sensor

3) Which component is primarily responsible for communication in LORA RF Module?
   a) Microcontroller b) Transceive
   c) Sensor d) Antenna

4) Which development board is commonly associated with NodeMCU?
   a) ESP32 b) Raspberry Pi
   c) Beagle Bone Black d) Intel Edison

5) Which programming environment is commonly used to program Node MCU boards?
   a) Node.js b) Python IDLE
   c) Arduino IDE d) Visual Studio Code

6) What does the analog Read() function do in Arduino?
   a) Reads the digital value of a pin
   b) Writes an analog value to a pin
   c) Reads the analog value of a pin
   d) Writes a digital value to a pin

7) Which library in Arduino provides functions for trigonometric calculations?
   a) Wire.h b) Math.h
   c) LiquidCrystal.h d) Servo.h

8) Which programming language is commonly used with NodeMCU?
   a) Python b) JavaScript
   c) C++ d) Ruby

B) Fill in the blanks Or True / False. **04**

1) Variables in Arduino programming are used to store data.
2) LORA RF module is used for wireless communication over long distances.
3) NodeMCU is known for its built-in RF connectivity.
4) digital Write() function in Arduino sets the digital value of a pin to either HIGH or LOW.

Q.2 Answer the following. (Any Six) **12**

a) Write the usage of strings and string objects in Arduino programming.
b) What is the concept of time function in Arduino?
c) What is the primary feature of NodeMCU?
d) What does the digital Write() function do in Arduino?
e) Write the program structure in Arduino.
f) How loops used in Arduino programming?
g) Which are the different board types of Arduino?
h) What is the main purpose of LORA RF module?

Q.3 Answer the following. (Any Three) **12**

a) Discuss the operators and control statements function in Arduino programming?
b) Discuss the features and specifications of the LORA RF module SX1278.
c) Discuss the concept of interrupt communication in Arduino.
d) Discuss the difference between parallel and serial communication.

Q.4 Answer the following. (Any Two) **12**

a) What is Pulse Width Modulation (PWM) in Arduino? How is it implemented using the Analog Write function?
b) Explain how variables and constants are declared and used. Provide examples to illustrate your answer.
c) Interfacing Temperature Sensor to Arduino - UNO. Use Arduino IDE to write the program to read Temperature data and display it on Serial monitor.

Q.5 Answer the following. (Any Two) **12**

a) Discuss the functions and features of Arduino function libraries, with a focus on I/O functions and pin modes.
b) Explain the process of programming in the NodeMCU using the Arduino IDE.
c) Explain how Arduino can be used to control the speed of a DC motor with Application.