R8421	Sub. Code
	542401

M.Sc. DEGREE EXAMINATION, APRIL – 2023

Fourth Semester

Materials Science

MOLECULAR SPECTROSCOPY

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. What is meant by molecular symmetry?
2. What is hybridization with example?
3. What is sp^2 and sp^3 hybrids?
4. Define stark effect.
5. What are stokes and anti-stokes lines?
6. Draw the vibrational spectra of IR active.
7. What is chemical shift?
8. What is multiphoton absorption process?
9. What are the importances of rotational spectroscopy?
10. How does spin interact with magnetic field?

Part B (5 × 5 = 25)

Answer **all** questions, choosing either (a) or (b).

11. (a) Write the difference between valence bond theory and molecular orbital theory.

Or

(b) Discuss the Heitler Landon theory for hydrogen molecule.

12. (a) Describe about the rigid and non-rigid rotators.

Or

(b) Elucidate the symmetric top molecules and it's rotational spectra.

13. (a) Discuss the mutual exclusion principle.

Or

(b) Explain the basic principle of microwave spectroscopy.

14. (a) Describe the non-linear Raman spectroscopy techniques.

Or

(b) How does photo acoustic spectroscopy work?

15. (a) What do you mean by NQR frequencies? Explain it use in molecular structure determination.

Or

(b) What are the limitations of ESR spectroscopy?

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Describe the hybridization and it's relation with molecular orbital theory.

17. Explain the instrumentation and operation of a IR spectrometer.

18. Discuss about the Frank-condon principle.

19. Derive Bloch equations and it's role in resonance spectroscopy.

20. Explain about the design of ESR spectrometer with neat illustration.

———————

R8422	Sub. Code
	542506

M.Sc. DEGREE EXAMINATION, APRIL – 2023

Fourth Semester

Materials Science

Elective – PYTHON PROGRAMMING

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** the questions.

1. What are the building blocks of algorithm?

2. Write any two advantages of pseudo code.

3. List out the difference between intermediate mode and script mode?

4. Define variable. Give example.

5. What is Boolean Expression?

6. How to split strings and what function is used to perform the operation?

7. What are the advantages of Tuple?

8. Write a few methods that are used in Python Lists.

9. How to open a new file in Python?

10. What is module and package in Python?

Part B (5 × 5 = 25)

Answer **all** the questions, choosing either (a) or (b).

11. (a) What is flowchart? Explain the Basic design structure in Flowchart.

Or

(b) Explain the steps involved in program development cycle.

12. (a) Explain function and module with suitable example.

Or

(b) Write the following python programs.

(i) Exchange the value of two variables.

(ii) Circulate the value of n variables.

13. (a) Briefly explain about function prototypes.

Or

(b) How to perform a user input in Python? Explain with example

14. (a) List out the difference between Lists and Tuples? Give an example for their usage.

Or

(b) Explain the purpose of loop structure in a programming language with example.

15. (a) What are packages? Give an example of package creation in Python.

Or

(b) Write a program to enter a number in Python and print its octal and hexadecimal equivalent.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Write the algorithm, pseudocode and draw the flowchart for the following:

    (a) Find minimum in a list.

    (b) Insert a card in a list of sorted cards.

    (c) Guess an integer number in a range.

    (d) Towers of Hanoi.

17. Write the following python programs**.**

    (a) Test whether a given year is leap year or not.

    (b) To print Fibonacci series.

    (c) To find factorial of a given number.

    (d) To convert Celsius to Fahrenheit.

18. Assuming num=125, determine the value of each of the following Python expressions.

    (a) num/125

    (b) num%100

    (c) (num==2 1)&(2<3)

    (d) not((num<45.9)&(6*2<=13))

19. What is Dictionary? Explain Python dictionaries in detail discussing its operations and methods.

20. Demonstrate the use of exception handling in Python.

R8423	Sub. Code
	542523

M.Sc. DEGREE EXAMINATION, APRIL – 2023

Fourth Semester

Materials Science

Elective : BIOSENSORS

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. Write down the essential features of biosensor?

2. What is meant by sensitivity?

3. Define transducers and give one example of it.

4. List some applications for piezoelectric transducers.

5. Define the term biorecognition.

6. What is meant by intact tissues?

7. How will you store information by using DNA?

8. Define molecular arrays as memory stores.

9. What is meant by glucose sensors?

10. Which type of sensor is used as a non-invasive glucose meter?

Part B (5 × 5 = 25)

Answer **all** questions, choosing either (a) or (b).

11. (a) Write short notes on

(i) Noise source and

(ii) Effects of noise at interface

Or

(b) Describe briefly about Ion-sensitive electrodes.

12. (a) Discuss the principles of piezo resistive sensors and applications.

Or

(b) Determine the uses of electrochemical transducers in the medical industry.

13. (a) Draw a neat sketch and explain about the design of enzyme based biosensor.

Or

(b) Summarize the functions of biomolecular computer.

14. (a) Describe various molecular switches and wires briefly.

Or

(b) Discuss the importance of molecular arrays in computer.

15. (a) Briefly explain about historical development and it's generation of glucose sensor.

Or

(b) Write short note on types of glucose monitoring devices.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Discuss in detail about the various components of a biosensor.

17. Explain the concept of primary transducer and secondary transducer with the help of suitable examples and diagram.

18. With in detail about the entire procedure of tissue cultures.

19. How will you creatre DNA-based sensors? Comment your ideas.

20. Explain in detail about invasive glucose meter and it's uses.

———————

R8424	Sub. Code
	542526

M.Sc. DEGREE EXAMINATION, APRIL – 2023

Fourth Semester

Materials Science

Elective – SMART MATERIALS AND STRUCTURES

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** the questions.

1. What are Functional materials?

2. Write any two examples of intelligent materials.

3. List out the hybrid smart materials.

4. What are Smart skins?

5. Why blood is considered as Bingham plastic?

6. State the principal characteristics of electro rheological fluids.

7. Define pyroelectricity.

8. How piezoelectric materials are used in smart structures?

9. What is the use of SMA in robotics?

10. Mention any two potential applications of SMA plastics.

Part B (5 × 5 = 25)

Answer **all** the questions, choosing either (a) or (b).

11. (a) What are smart materials? Explain its applications in various fields.

Or

(b) Explain the technological applications of Intelligent materials.

12. (a) What are the ingredients of smart materials? Explain with suitable example.

Or

(b) Discuss in detail the synthesis of future smart systems.

13. (a) Briefly explain the charge migration mechanism for the dispersed phase.

Or

(b) Describe the designing parameters of electro rheological fluid and its application

14. (a) Explain the properties of piezoelectric film.

Or

(b) What is SAW Filter? Explain the advantages and applications of SAW filters.

15. (a) List out the characteristics of Nitinol SMA in detail.

Or

(b) Define SMA fibres and explain its applications.

Part C (3 × 10 = 30)

Answer any **three** of the following questions.

16. Write short note on :
    (a) Hybrid Materials
    (b) Structural materials
    (c) Polyfunctional materials
    (d) Biocompatible materials
    (e) Intelligent biological materials

17. What are the different actuator materials? Explain reactive actuator based smart structures.

18. What is an electro rheological phenomenon? Discuss the electro rheological fluids and fluid actuators.

19. Illustrate with example the industrial piezoelectric materials and their properties.

20. List and explain the applications of Shape Memory Alloys (SMA).

———————