[This question paper contains 2 printed pages.]

Your Roll No.....

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Sr. No. of Question Paper : 9497

Unique Paper Code : 2513040022

Name of the Paper : Materials Sciences for Sensors Development

Name of the Course : **B.Sc. (Hons)Instrumentation (DSE)**

Semester : VII

Duration : 3 Hours

Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **five** questions in all. Question No. **1** is compulsory.
3. All questions carry equal marks.
4. Use of a Non- programmable Scientific calculator is allowed.

Q.1 (3)

(a) What are passive materials ? Give two examples.

(b) Determine for the diffracted planes (111), (200) and (220) whether the metal crystal structure is FCC, BCC or neither FCC or BCC . (3)

(c) Differentiate between organic and inorganic materials . (3)

(d) What is Piezoelectricity? Explain its basic working principle. (3)

(e) What are 2D materials ? Give examples (3)

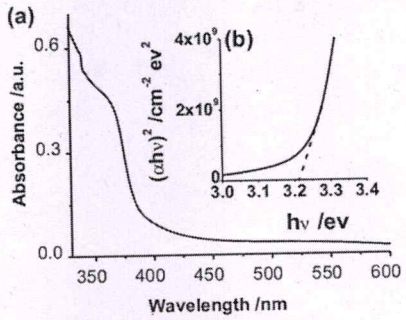
(f) What do you understand by the term " Smart materials" ? Why they are preferred nowadays? (3)

Q.2

(a) Explain the importance of materials science in the field of instrumentation and sensor design. (6)

(b) Mention the advantages, disadvantages and basic principle of XRD (6)

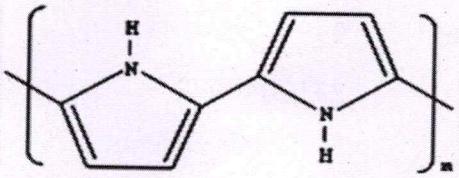
(c) Draw the diagram of single beam spectrophotometer . What information are you getting from the figure given below ? (6)



Q.3

(a) Identify the structure and write its properties and applications . Explain its conducting mechanism also . (6)

P.T.O.



(b) What are compound materials? How they are different from ternary and quaternary materials? (6)

(c) What is ZnO ? Write its chemical and physical properties . (6)

Q.4

(a) Compare natural, ceramic, and polymer-based piezoelectric materials with suitable examples. (6)

(b) What is Graphene? How is it differ from carbon nanotubes (CNTs) ? (6)

(c) What is full form of TMDs? Write its applications (at least three). (6)

Q.5

(a) What is magnetoresistive materials ? Write the basic working principle of a magnetoresistor? (6)

(b) Write properties and applications of shape memory alloys (SMA) as a smart material. (6)

(c) Discuss in detail the role of materials in the performance and sensitivity of sensors. (6)

Q.6

(a) What do you mean by electronic transition in a molecule? Explain it with energy diagram. (6)

(b) What is IR Spectroscopy? Explain its basic principle and applications. (6)

(c) What is NMR? Draw its block diagram and explain its working. Also , mention few applications . (6)

Q.7

(a) Discuss the working principle and applications of Quartz crystal as an piezoelectric sensor material. (6)

(b) What is magnetoelectric effect? How do you measure the polarization of a multiferroic material? (6)

(c) Explain the role of Transition Metal Dichalcogenides (TMDs) in chemical sensing applications . (6)