



PS-003-1204004

Seat No. _____

M. Sc. (Physics) (Sem. IV) Examination

August - 2020

Physics : ET-08

(Functional Materials)

Faculty Code : 003

Subject Code : 1204004

Time : $2\frac{1}{2}$ Hours]

[Total Marks : 70

- Instructions :** (1) Attempt all questions.
(2) All questions carry equal marks.
(3) Mathematical symbols have equal meanings.

- 1** Answer in brief any **seven** : **14**
- (a) Define functional materials. Give examples. **2**
 - (b) What are Type I and Type II multiferroics? Give examples. **2**
 - (c) Define magnetoelectric (ME) effect. **2**
 - (d) What is the perovskite structure? **2**
 - (e) Write the expressions for $\langle r_A \rangle$ and σ_A^2 in manganites. **2**
 - (f) Draw a well labeled diagram of Y123 superconductor. **2**
 - (g) Which factors are affecting the superconductivity in YBCO (Y123) compound? **2**
 - (h) Define the normal and inverse spinel ferrites. **2**
 - (i) What are the applications of ferrites? **2**
 - (j) Write the applications of DMS materials. **2**
- 2** Answer any two of following questions : **14**
- (a) Discuss on classification of multiferroic materials. **7**
 - (b) Discuss magnetoelectric effect in multiferroics and multiferroicity in $YMnO_3$. **7**
 - (c) Describe in detail the applications of multiferroics. **7**

- 3 (a) Write a note in detail on zener double exchange mechanism in mixed valent rare earth perovskite manganites. 7
- (b) Discuss in-depth Jahn-Teller (JT) distortion in perovskite manganites. 7
- OR**
- (a) What is the role of Mn-O-Mn bond angle and Mn-O bond length in manganites? 7
- (b) Describe various phases of $\text{La}_{1-x}\text{Sr}_x\text{MnO}_3$ manganite using its phase diagram. 7
- 4 Answer any two of following questions : 14
- (a) What are ferrites? Discuss in detail their types and properties. 7
- (b) Write a note on Bound Magnetic Polaron (BMP) model explaining the origin of ferromagnetism in DMS materials. 7
- (c) Explain various properties of DMS materials. 7
- 5 Answer any two of following questions : 14
- (a) Explain in-depth the synthesis of $\text{YBa}_2\text{Cu}_3\text{O}_7$ superconductor using solid state reaction method with its advantages and disadvantages. 7
- (b) What are different families of high T_C superconductors? Give suitable examples. 7
- (c) Discuss in detail the role of copper and oxygen in Y123 superconductors. 7
- (d) What are the applications of HTSC superconductors? Comment on SQUID magnetometer. 7
-