



**NBX-003-020403** Seat No. \_\_\_\_\_

**M. Sc. (Sem. IV) (CBCS) Examination**

**April / May - 2017**

**Physics : ET - 03**

**(Functional Materials)**

**Faculty Code : 003**

**Subject Code : 020403**

Time : 3 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) What are diluted magnetic semiconductors? Give two 2  
examples.
  - (b) Define MR in manganites. What is meant by positive 2  
and negative MR?
  - (c) Define magnetoresistance and charge ordering in 2  
manganites.
  - (d) Define tolerance factor ( $t$ ) and size variance ( $\sigma^2$ ) 2  
in manganites.
  - (e) What are fundamental requirements for multiferroicity? 2
  - (f) Give examples of type I and type II multiferroics. 2
  - (g) What are the limitations for the practical 2  
applications of  $\text{BiFeO}_3$ ?
  - (h) Draw a well labeled diagram of  $\text{YBa}_2\text{Cu}_3\text{O}_7$  2  
superconductor.
  - (i) List various families of HTSC compounds. 2
  - (j) List various applications of ferrites. 2

- 2** Answer any two of following questions: **14**
- (a) Describe in detail the synthesis of  $\text{YBa}_2\text{Cu}_3\text{O}_7$  superconductor using solid state reaction method. What are advantages and disadvantages of this method? **7**
- (b) Discuss the role of copper in Y123 superconductor. **7**
- (c) Discuss the role of oxygen in Y123 superconductors. **7**
- 3** (a) Explain various properties and applications of DMS materials. **7**
- (b) Write a note on Bound Magnetic Polaron (BMP) model explaining the origin of ferromagnetism in DMS materials. **7**
- OR**
- 3** (a) What are ferrites? Give their types and properties. **7**
- (b) Discuss in detail various applications of ferrites. **7**
- 4** Answer any two of following questions: **14**
- (a) Give various properties and applications of  $\text{BiFeO}_3$  multiferroic. **7**
- (b) What are the basic requirements for multiferroicity? Why multiferroicity in  $\text{YMnO}_3$  is accidental by product? **7**
- (c) Describe in detail lone pair, hexagonal and charge ordered multiferroics. **7**
- 5** Answer any two of following questions : **14**
- (a) Describe the role of zener double exchange and Jahn-Teller distortion in mixed valent manganites. **7**
- (b) Draw a well labeled phase diagram of  $\text{La}_{1-x}\text{Ca}_x\text{MnO}_3$  manganite and discuss various phases present. **7**
- (c) Draw a well labeled phase diagram of  $\text{La}_{1-x}\text{Sr}_x\text{MnO}_3$  manganite and discuss its various phases. **7**
- (d) Discuss various applications of CMR manganites. **7**