

M.Sc. Semester-III (C.B.C.S.) Examination**PHYSICS****Paper—3PHY4 (ii) Condensed Matter Physics-I**

Time : Three Hours]

[Maximum Marks : 80

Note :— ALL questions are compulsory and carry equal marks.

1. (a) Discuss the significance of negative effective mass. 4
- (b) Give Kronig-Penney model to explain presence of energy level band structure separated with forbidden energy gaps. 9
- (c) Discuss the Bloch function. 3

OR

- (p) Discuss in detail the behaviour of electron in crystal under nearly free electron approximation. 10
- (q) What is an effective mass ? 2
- (r) Derive relation for an effective mass. 4
2. (a) Discuss paramagnetic cooling in detail. 4
- (b) Explain origin of paramagnetic moment. Give classical theory of paramagnetism. 10
- (c) What is Larmor precession ? 2

OR

- (p) Give quantum theory of diamagnetism. 10
- (q) Discuss quenching in iron group ions. 4
- (r) What is magnetic moment ? 2
3. (a) Derive relation for Bloch $T^{3/2}$ law. 7
- (b) Explain Heisenberg model of molecular field in detail. 9

OR

- (p) Give in detail molecular field theory of ferrimagnetisms and explain variation of susceptibility with temperature. 7
- (q) What is spin wave ? Derive a dispersion relation. 9

4. (a) Discuss antiferroelectricity and piezoelectricity. 6
 (b) Derive relation for dipole polarisability and discuss its variation with temperature and frequency. 10

OR

- (p) What is ferroelectricity ? Derive Currie-Weiss law for ferroelectricity. 10
 (q) Derive Clausius-Mossotti relation. 6
 5. (a) Derive the Ginzberg-Landau equation and discuss flux quantisation. 8
 (b) Discuss in brief the BCS theory. 3
 (c) Discuss high T_c superconductors. 5

OR

- (p) What is the Flux Quantisation ? Derive a relation for quantised flux. 8
 (q) Discuss infrared property of superconductors. 3
 (r) What is the DC-Josephson effect ? Derive a relation for DC current flowing across Josephson junction. 5