

**DD-126**

December-2018

M.Sc., Sem.-I

404 : Physics

**(Solid State Physics and Electronics-I)**

Time : 2:30 Hours]

[Max. Marks : 70

1. (A) (i) State the Bloch theorem and discuss it in detail. 7  
(ii) Discuss behaviour of an electron in a periodic potential. 7
- OR**
- (i) Explain nearly free electron approximation in detail. 7  
(ii) Explain approximate solution of the wave equation near a zone boundary. 7
- (B) Answer in brief any **four** questions from the following : (Each questions is of **one** mark) 4
- (i) Differentiate the metal and insulator in terms of energy gap.  
(ii) Which information you will get from Kronig-Penny model ?  
(iii) State Bloch function,  
(iv) Define energy gap.  
(v) What do you mean by periodic potential ?  
(vi) What do you mean by crystal structure ?
2. (A) (i) Using tight binding approximation, discuss energy bands in the simple cubic crystal. 7  
(ii) Discuss construction of Fermi surfaces in crystals. 7
- OR**
- (i) Explain width of bands in case of tight binding approximation. 7  
(ii) Discuss de-Haas-Van Alphen effect in detail. 7
- (B) Answer in brief any **four** questions from the following : (Each questions is of **one** mark) 4
- (i) The de-Haas-Van-Alphen effect offers the most precise measurements of \_\_\_\_\_ in metals.  
(ii) State the validation of tight binding approximation.  
(iii) Which information you will get from the Wigner-Seitz model ?  
(iv) What do you mean by cohesive energy ?  
(v) Define Fermi energy.  
(vi) Define effective mass in case of metal.

3. (A) (i) Draw circuit diagram of Class B push pull power amplifier and explain its working. Using graphical method of analysis show that its maximum theoretical conversion efficiency is 78.5 %. 7
- (ii) Giving neat circuit diagram, explain working of a class A push-pull power amplifier. Show that the even harmonics are absent in the output. 7

**OR**

- (i) Draw circuit diagram of astable multivibrator using BJT. Giving voltage timing diagrams explain its working. 7
- (ii) What are multivibrators? What are its types? Explain clearly how they are different in their operation.

An astable multivibrator is operated with supply voltage,  $V_{CC} = 12 \text{ V}$ . Determine the value of capacitors to use to provide a symmetrical oscillation of 50 kHz if  $R_1 = R_2 = 4.7 \text{ k}\Omega$  7

- (B) Answer in brief any **three** questions from the following : (Each questions is of **one** mark) 3

- (i) List the main properties of Class C power amplifier,
- (ii) Define harmonic distortion.
- (iii) What is the function of input transformer in a push-pull amplifier ?
- (iv) What is class AB amplifier ?

4. (A) (i) Draw basic circuit of a phase shift oscillator using operational amplifier. Sketch the circuit waveforms, and briefly explain the circuit operation. 4
- Write the oscillating frequency equation. Discuss the amplifier gain requirements. 3
- (ii) Explain application of Operational amplifier as Differential bridge amplifier. 7

**OR**

- (i) (1) Draw the circuit diagram for an integrating circuit. Sketch the output waveform produced by a rectangular waveform input to the inverting circuit. Explain the output waveform. 7
- (2) Explain the term: Slew rate.
- (ii) Write a short note on: Frequency compensation in operational amplifier. 7

- (B) Answer in brief any **three** questions from the following : (Each questions is of **one** mark) 3

- (i) What is the difference between actual ground and virtual ground ?
- (ii) What is voltage follower circuit?
- (iii) Define term " dB / octave".
- (iv) Explain the terms 'inverting terminal' and 'non-inverting terminal' as applied to an op-amp.