

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.Sc. FOURTH SEMESTER EXAMINATION, MAY 2015

SECOND YEAR

PHYSICS (General)

Paper : IV

Date : 30/05/2015

Time : 10.30 am – 12.30 pm

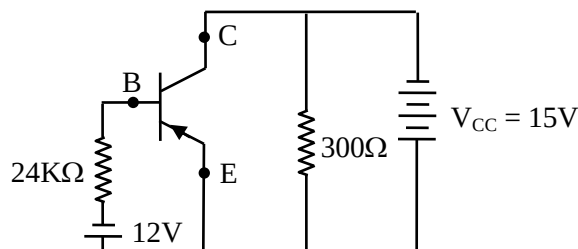
Full Marks : 50

[Use a separate Answer Book for each group]

Group – A

[Answer **any two** questions]

1. a) Explain the action of p-n junction diode in forward and reverse bias. [4]
b) Describe the operation of diodes in rectification within a bridge rectifier. Hence explain the importance of a capacitor as a filter. [4+2]
2. a) What are input and output characteristics of a transistor in Common Emitter Mode. [2]
b) Draw the necessary circuit for a p-n-p transistor in CE mode for characteristic curves. Define the three regions; active, saturation and cutoff in the output characteristic. Establish the relation between α and β of a transistor. [1+3+1]
c) In the given circuit the transistor has $\beta = 30$. Find the values of I_B , I_C and V_{CE} . [3]



3. a) What is Zener diode? Explain how Zener diode maintains constant voltage across the load? [5]
b) Compare the characteristic curves of Zener and ordinary diodes? What are the basic differences between these two diodes. [3+2]
4. a) State and explain De Morgan's theorem. Explain the action of half adder and full adder with diagram and truth table. [3+4]
b) Convert the decimal number 427 into binary. [3]

Group – B

[Answer **any three** questions]

5. a) What is a photon? How does it differ from a particle?
State the characteristics of photoelectric emission. Hence write down Einstein's equation for photoelectric emission. [2+3+1]
b) The work function for lithium is 4.6×10^{-19} Joule. Calculate the lowest frequency of radiation for photoelectric emission from lithium. Find the maximum energy of photoelectron when the frequency of incident radiation is 7.3×10^{14} Hz. [4]
6. a) Define atomic mass unit (amu). What do you mean by binding energy of nucleus? Explain its importance. [1+2+4]
b) Calculate the binding energy per nucleon of ^{16}O nucleus. Given mass of proton and neutron are 1.008145 and 1.008986 respectively and mass of ^{16}O is 16.279069. All values are in amu. [3]
7. a) What do you mean by Raman Scattering? State the characteristics of Raman scattering. What are Stoke's and anti-Stokes lines. [1+3+2]
b) Compare the basic differences between Raman and Compton effects. [4]

8. a) Explain the concepts of lattice and crystal structure. What are Miller indices? How are they determined? [2+2+2]
 b) Write down Bragg's equation for X-ray diffraction. Explain the different parameters in it. [2]
 c) In a crystal lattice $a = b = 2.5 \text{ \AA}$ and $c = 1.8 \text{ \AA}$. Find the distance between adjacent planes with Miller indices (1, 1, 1) and (2, 1, 3). [2]
9. a) State the basic postulates of Einstein's special theory of relativity.
 If the total energy of a particle is exactly twice its rest mass energy, calculate the speed of the particle. [2+3]
 b) What do you mean by length contraction and time dilation in relativity? Write down the formula in each case. [5]
10. a) What do you mean by wave-particle duality in basic quantum mechanics? Write down the equation of de-Broglie wave. Show that de-Broglie wave associated with an electron of energy V electron Volt is nearly $\frac{12.27}{\sqrt{V}}$. [1+1+3]
 b) Deduce Schrodinger wave equation for free particle. Find the probability that a particle in a 1-D box of length L can be found in the range $0.4L$ and $0.6L$, for ground State. [3+2]

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