**Subject Code: R10203/R10** **Set No - 1**

**I B.Tech II Semester Regular Examinations Oct./Nov. - 2013**

# ENGINEERING PHYSICS - II

**(Common to All Branches)**

**Time: 3 hours** **Max. Marks: 75**

**Answer any FIVE Questions**
**All Questions carry equal marks**

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1.(a) Write down time dependent and time independent Schrodinger wave equations.
(b) Show that the energy of an electron confined in a one dimensional potential well of length L and infinite depth is quantized.
(c) The electron trapped in potential well cannot have zero energy. Explain, why? [4+9+2]

2.(a) Explain the terms 'Drift Velocity' and 'Carrier Mobility'.
(b) What are assumptions of classical free electron theory?
(c) Based on classical free electron theory, derive an expression for electrical conductivity in metals. [3+4+8]

3.(a) Discuss with suitable mathematical expressions, the motion of an electron in a periodic potential.
(b) Explain how the above theory leads to the concept of band structure of solids.
(c) What is effective mass of electron? [8+4+3]

4.(a) What are ferromagnetic materials? Write notes on hysteresis.
(b) How would you use the hysteresis curves to select material for the construction of permanent magnets?
(c) Diamagnetic $Al_2O_3$ is subjected to external magnetic field of $10^5$ A/m. Evaluate magnetization and magnetic flux density in $Al_2O_3$. (Susceptibility of $Al_2O_3 = -5x10^{-5}$). [9+2+4]

5.(a) Explain the significance of three critical parameters of superconductors.
(b) Explain ac and dc Josephson's effect. Discuss the applications of Josephson's effect. [6+9]

6.(a) What do you understand by dielectric constant? Define dielectric susceptibility. Derive the relation between dielectric constant and dielectric susceptibility.
(b) Explain electronic polarisability and show that electronic polarisability for a mono atomic gas increases as the size of the atom becomes larger. [5+10]

7.(a) Write the expressions for electron and hole concentrations in an intrinsic semiconductor and hence derive the expression for Fermi energy in an intrinsic semiconductor.
(b) How does the electrical conductivity vary with temperature for an intrinsic semiconductor?
(c) If the effective mass of electron is equal to twice the effective mass of hole, determine the position of the Fermi level in an intrinsic semiconductor from the centre of forbidden gap at room temperature. [6+5+4]

8. Write a brief note on
(i) Nano materials
(ii) Flux quantization
(iii) Hall effect [5+5+5]

**Subject Code: R10203/R10** **Set No - 2**

**I B.Tech II Semester Regular Examinations Oct./Nov. - 2013**

# ENGINEERING PHYSICS - II

**(Common to All Branches)**

**Time: 3 hours** **Max. Marks: 75**

**Answer any FIVE Questions**
**All Questions carry equal marks**

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1.(a) Show that the solution of Schrodinger's equation for a particle in an infinite potential well leads to the concept of quantization of energy. Obtain Eigen functions for the particle. Show necessary wave forms.
(b) Find the lowest energy of an electron confined to move in a one dimensional box of length 1Å. Express the result in electron volts.
[11+4]

2.(a) What are the drawbacks of the classical free electron theory?
(b) Derive an expression for electrical conductivity of a conducting material based on quantum mechanical treatment.
(c) Find the relaxation time of conduction electrons in a metal if its resistivity is $1.54 \times 10^{-8} \Omega m$ and it has $5.8 \times 10^{28}$ conduction electrons/$m^3$.
[3+8+4]

3.(a) Discuss with suitable mathematical expressions, the motion of an electron in a periodic potential.
(b) Explain how the above theory leads to the concept of band structure of solids.
(c) What is effective mass of electron?
[8+4+3]

4.(a) Explain magnetic flux density, B, magnetic field strength, H and Magnetisation M. Derive the relation between them.
(b) Describe dia, para and ferromagnetic materials. Explain their classification on the basis of permanent magnetic moment.
[6+9]

5.(a) What is superconductivity? Explain Meissner effect. Describe type-I and type-II superconductors.
(b) Discuss the applications of superconductors.
[12+3]

6.(a) What do you understand by dielectric constant? Define dielectric susceptibility. Derive the relation between dielectric constant and dielectric susceptibility.
(b) Explain electronic polarisability and show that electronic polarisability for a mono atomic gas increases as the size of the atom becomes larger.
[5+10]

7.(a) Write notes on drift and diffusion currents.
(b) Obtain the expression for density of electrons in the conduction band of an n-type extrinsic semiconductor.
[6+9]

8. Write a brief note on
(i) Nano tubes
(ii) Clausius-Mosotti equation
(iii) Bloch theorem [5+5+5]

**Subject Code: R10203/R10** **Set No - 3**

**I B.Tech II Semester Regular Examinations Oct./Nov. - 2013**

# ENGINEERING PHYSICS - II

**(Common to All Branches)**

**Time: 3 hours** **Max. Marks: 75**

**Answer any FIVE Questions**
**All Questions carry equal marks**

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1.(a) Write down time dependent and time independent Schrodinger wave equations.
(b) Show that the energy of an electron confined in a one dimensional potential well of length L and infinite depth is quantized.
(c) The electron trapped in potential well cannot have zero energy. Explain, why?
[4+9+2]

2.(a) What are the drawbacks of the classical free electron theory?
(b) Derive an expression for electrical conductivity of a conducting material based on quantum mechanical treatment.
(c) Find the relaxation time of conduction electrons in a metal if its resistivity is $1.54 \times 10^{-8} \Omega m$ and it has $5.8 \times 10^{28}$ conduction electrons/$m^3$.
[3+8+4]

3.(a) Explain the formation of energy bands in solids and explain in detail how solids are classified on the basis of energy band gap.
(b) According to band theory, a completely filled or empty band is not associated with electrical conduction. Only partially filled band is responsible for electrical conduction. Explain.
[10+5]

4.(a) What are ferromagnetic materials? Write notes on hysteresis.
(b) How would you use the hysteresis curves to select material for the construction of permanent magnets?
(c) Diamagnetic $Al_2O_3$ is subjected to external magnetic field of $10^5$ A/m. Evaluate magnetization and magnetic flux density in $Al_2O_3$. (Susceptibility of $Al_2O_3 = -5 \times 10^{-5}$).
[9+2+4]

5.(a) What is superconductivity? Explain Meissner effect. Describe type-I and type-II superconductors.
(b) Discuss the applications of superconductors.
[12+3]

6.(a) Distinguish between electronic, ionic and orientation polarization and discuss the effect of temperature on each of them.
(b) Deduce an expression for Lorentz field relating to a dielectric material.
[7+8]

7.(a) Write notes on drift and diffusion currents.
(b) Obtain the expression for density of electrons in the conduction band of an n-type extrinsic semiconductor.
[6+9]

8. Write a brief note on
(i) Nano materials
(ii) Flux quantization
(iii) Hall effect [5+5+5]

**Subject Code: R10203/R10** **Set No - 4**

**I B.Tech II Semester Regular Examinations Oct./Nov. - 2013**

# ENGINEERING PHYSICS - II

**(Common to All Branches)**

**Time: 3 hours** **Max. Marks: 75**

**Answer any FIVE Questions**
**All Questions carry equal marks**

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1.(a) Show that the solution of Schrodinger's equation for a particle in an infinite potential well leads to the concept of quantization of energy. Obtain Eigen functions for the particle. Show necessary wave forms.
(b) Find the lowest energy of an electron confined to move in a one dimensional box of length 1Å. Express the result in electron volts.
[11+4]

2.(a) Explain the terms 'Drift Velocity' and 'Carrier Mobility'.
(b) What are assumptions of classical free electron theory?
(c) Based on classical free electron theory, derive an expression for electrical conductivity in metals.
[3+4+8]

3.(a) Explain the formation of energy bands in solids and explain in detail how solids are classified on the basis of energy band gap.
(b) According to band theory, a completely filled or empty band is not associated with electrical conduction. Only partially filled band is responsible for electrical conduction. Explain.
[10+5]

4.(a) Explain magnetic flux density, B, magnetic field strength, H and Magnetisation M. Derive the relation between them.
(b) Describe dia, para and ferromagnetic materials. Explain their classification on the basis of permanent magnetic moment.
[6+9]

5.(a) Explain the significance of three critical parameters of superconductors.
(b) Explain ac and dc Josephson's effect. Discuss the applications of Josephson's effect.
[6+9]

6.(a) Distinguish between electronic, ionic and orientation polarization and discuss the effect of temperature on each of them.
(b) Deduce an expression for Lorentz field relating to a dielectric material.
[7+8]

7.(a) Write the expressions for electron and hole concentrations in an intrinsic semiconductor and hence derive the expression for Fermi energy in an intrinsic semiconductor.
(b) How does the electrical conductivity vary with temperature for an intrinsic semiconductor?
(c) If the effective mass of electron is equal to twice the effective mass of hole, determine the position of the Fermi level in an intrinsic semiconductor from the centre of forbidden gap at room temperature.
[6+5+4]

8. Write a brief note on
(i) Nano tubes
(ii) Clausius-Mosotti equation
(iii) Bloch theorem [5+5+5]