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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Second Semester, B.E. - Semester End Examination; May/June - 2018

Engineering Physics

(Common to all Branches)

Time: 3 hrs *Max. Marks: 100*

Course Outcome

The Students will be able to:

*CO1: **Understand** the basic **concepts** and **principles** of Physics in describing the phenomena related to engineering field.*
*CO2: **Explain** the **properties** of various materials like metals, dielectrics, semiconductors, superconductors, nanomaterials applicable to engineering field.*
*CO3: **Apply** the **knowledge** of Physics allied with the field of engineering applications.*
*CO4: **Formulate** the **expressions** for the concepts of Physics pertaining to engineering field.*
*CO5: **Analyze** by solving the **problems** in Physics for better understanding of engineering concepts.*

Note: Answer **FIVE** full questions, selecting **ONE** full question from each **Unit**

Physical constants: *Electron mass, $m = 9.11x10^{-31}$ kg, Electron charge, $e = 1.602x10^{-19}$ C; Velocity of light, $c = 3x10^{8}$ ms^{-1}; Planck's constant, $h = 6.626x10^{-34}$ Js; Boltzmann constant, $K = 1.38x10^{-23}$ JK^{-1}; Avogadro number, $N = 6.025x10^{23}$/mole; Permittivity of free space, $\varepsilon_o = 8.85x10^{-12}$ Fm^{-1}.*

Q. No.	Questions	Marks	CO	BL	PO
	UNIT - I				
1 a.	i) Define the three modulli of elasticity.	2	CO1	L1	PO1
	ii) Explain the Poisson's ratio must lies between -1 and 0.5 using the relation between three modulli of elasticity.	6	CO2	L2	
b.	i) Define Piezoelectricity and Ferroelectricity.	3	CO1	L1	PO1
	ii) Mention the applications of dielectric materials.	4	CO3		
c.	i) What is bending of beam?	5	CO1	L1	PO1
	ii) Explain I-shaped girders.		CO2	L2	
2 a.	i) Define Dielectric loss.	2	CO1	L1	PO1
	ii) Derive Clausius-Mossotti equation for a dielectric material.	6	CO4	L3	
b.	Derive an expression for Yong's modulus (q) by uniform bending method.	7	CO4	L3	PO1
c.	The dielectric constant of sulphur is 3.4, assuming the internal field as Lorentz field; calculate the electronic polarizability of sulphur. Give that density of sulphur = $2.07x10^3$ kg/m^3 and atomic weight = 32.07.	5	CO5	L3	PO2
	UNIT - II				
3 a.	How black body radiation spectrum can be explained using Planck's law, Wien's law and Rayleigh-Jeans law.	8	CO1	L1	PO1
b.	i) What is wave function?	7	CO1	L1	PO1
	ii) Explain the physical significance of a wave function.		CO2	L2	
c.	Compare the de-Broglie wavelength of a 2000 kg automobile travelling at a speed of 50 m/s and 0.2 kg bullet travelling at a speed of 250 m/s.	5	CO5	L2	PO2
4 a.	Solve Schrodinger's wave equation for allowed energy values in case of a particle in an infinite potential well.	8	CO4	L3	PO1
b.	i) Mention the characteristics properties of matter wave.	2	CO1	L1	PO1
	ii) Obtain the relation between group velocity, phase velocity and velocity of light.	5	CO3	L3	
c.	An electron is bound in one dimensional potential box of width $4x10^{-10}$ m. compute the energy and de-Broglie wavelengths in ground state and first excited state.	5	CO5	L3	PO2

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	UNIT - III				
5 a.	Derive an expression for the hole concentration in an intrinsic semiconductors.	8	CO4	L3	PO1
b.	Explain the variation of Fermi energy with temperature at T = 0 K and T > 0 K.	7	CO2	L2	PO1
c.	Show that, $E_F = \left(\frac{E_C + E_V}{2}\right) - \frac{3}{4}kT\ln\left(\frac{m_e^*}{m_h^*}\right)$.	5	CO3	L3	PO1
6 a.	i) Define density of states.	1	CO1	L1	PO1
	ii) Derive an expression for the density of states for conduction electrons for unit volume of metal.	7	CO4	L3	
b.	Explain the significance of Fermi level in intrinsic and extrinsic semiconductors.	7	CO2	L2	PO1
c.	Calculate the probability of an electron occupying an energy level of 0.05 eV at 500 K above and below the Fermi level.	5	CO5	L3	PO2
	UNIT - IV				
7 a.	i) What are superconductors?	2	CO1	L1	PO1
	ii) Write a note on temperature dependence of resistivity and critical magnetic field in a superconductor.	6	CO1	L2	
b.	Write a brief note on Carbon nanotubes and their types with some important properties.	7	CO1	L2	PO1
c.	i) Define Isotopic effect.	5	CO1	L1	PO1
	ii) In a superconducting material Isotopic mass is 199.5 amu and critical temperature is 5 K. Calculate isotopic mass at 5.2 K.		CO5	L3	PO2
8 a.	Explain the confinement of electron energy states in 0D, 1D, 2D and 3D system.	8	CO2	L2	PO1
b.	Explain Meissner's effect and Type – II superconductor.	7	CO2	L2	PO1
c.	Discuss briefly on Scanning Tunneling Microscope (STM).	5	CO2	L2	PO1
	UNIT - V				
9 a.	i) Define metastable state.	2	CO1	L1	PO1
	ii) Write a note on population inversion.	3	CO1	L2	
b.	i) Define angle of acceptance and numerical aperture.	2	CO1	L1	PO1
	ii) With a neat diagram, explain step index multimode optical fiber.	3	CO2	L2	
c.	i) What is meant by non-destructive method of testing the materials?	2	CO1	L1	PO1
	ii) An ultra sound pulse sent by a source in sea is reflected by a submerged target at a distance 597.5 m and reaches the sources after 0.83 s. Find the velocity of sound in sea water.	3	CO5	L3	PO2
d.	Discuss the various factors affecting the acoustics of an auditorium.	5	CO2	L2	PO1
10 a.	A pulse from laser with power 1 mW last for 9 ns. If the number of photons emitted per second is 3.41×10^7, calculate the wavelength of laser.	5	CO5	L3	PO1
b.	Calculate the numerical aperture and angle of acceptance of a given optical fiber, if the refractive index of core and cladding are 1.55 and 1.50 respectively.	5	CO5	L3	PO2
c.	Write a brief note on applications of ultrasonic waves in different fields.	5	CO3	L2	PO1
d.	What are the basic requirements of a good acoustics?	5	CO1	L1	PO1

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