K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE -560109
DEPARTMENT OF SCIENCE AND HUMANITIES
I SESSIONAL TEST QUESTION PAPER 2018 – 19 ODD SEMESTER

SET-B

USN | | | | | | | | | | |

Degree	: B.E	**Semester**	: I
Branch	: CSE / CV / EEE	**Date**	: 18-9-2019
Course Title	: Engineering Physics	**Course Code**	: 18PHY12
Duration	: 90 Minutes	**Max Marks**	: 30

Constants: *Charge of an electron $e = 1.6\times10^{-19}C$, Planck's constant $h = 6.625\times10^{-34}Js$, velocity of light $c=3\text{x}10^{8}$m/s, mass of an electron $m = 9.1\times10^{-31}kg$*

Note: Answer ONE full question from each part

Q. No.	Question	Marks	K Level	CO mapping
	PART-A			
1(a)	**Define** simple harmonic motion. **Derive** the equation of motion for SHM.	5	Applying K3	CO1
(b)	A free particle is executing simple harmonic motion in a straight line. The maximum velocity it attains during any oscillation is 62.8 m/s. **Calculate** the frequency of oscillation, if its amplitude is 0.5 m.	5	Applying K3	CO1
(c)	**Obtain** one-dimensional time-independent Schrödinger wave equation.	5	Applying K3	CO2
	OR			
2(a)	**Define** spring constant. **Derive** the expressions for equivalent force constant for two springs in parallel combination.	5	Applying K3	CO1
(b)	A vibration system of natural frequency 500 cycles/second is forced to vibrate with a periodic force/unit mass of amplitude $100\text{x}10^{-5}$ N/kg in the presence of a damping/unit mass of 0.01×10^{-3} rad/s. **Calculate** the maximum amplitude of vibration of the system.	5	Applying K3	CO1
(c)	**Solve** the Schrödinger's wave equation for the allowed energy values in the case of a particle in a box.	5	Applying K3	CO2
	PART-B			
3(a)	**Obtain** the theory of damped oscillations.	5	Applying K3	CO1
(b)	**Describe** the construction & working of Reddy shock tube with the help of a diagram.	5	Understand K2	CO1
(c)	**Show that** an electron cannot exist within the nucleus of an atom.	5	Applying K3	CO2
	OR			
4(a)	**Obtain** an expression for amplitude of vibration of a body undergoing forced oscillations.	5	Applying K3	CO1
(b)	**Explain** the basic of conservation of mass, momentum and energy.	5	Understand K2	CO1
(c)	In a measurement of position and velocity of an electron moving with a speed of 6×10^{5} *m/s*, **calculate** the highest accuracy with which its position could be determined if the inherent error in the measurement of its velocity is 0.01% for the speed stated.	5	Applying K3	CO2

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K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE -560109
DEPARTMENT OF SCIENCE AND HUMANITIES

I SESSIONAL SCHEME AND SOLUTION 2018 – 19 ODD SEMESTER

SET-B

USN										

Degree	: **B.E**	**Semester**	: **I**
Branch	: **Science and Humanities**	**Date**	: **18-9-2019**
Course Title	: **Engineering Physics**	**Course Code**	: **18PHY12**
Duration	: **90 Minutes**	**Max Marks**	: **30**

Constants: *Charge of an electron $e = 1.6\times10^{-19}$C, Planck's constant $h = 6.625\times10^{-34}$Js, velocity of light c=3x10^{8}m/s, mass of an electron $m = 9.1\times10^{-31}$kg*

Note: Answer ONE full question from each part

Q. No.	Question	Marks	K Level	CO mapping
	PART-A			
1(a)	**Define** simple harmonic motion. **Derive** the equation of motion for SHM.	**5**	Applying K3	**CO1**
Sol	Definition of SHM Starting from Hooke's law $F = -ky$ Using Newton's Second Law $F = ma$ Arrive at $\frac{d^2y}{dt^2} + \omega^2 y = 0$	**1** **1** **1** **2**		
(b)	A free particle is executing simple harmonic motion in a straight line. The maximum velocity it attains during any oscillation is 62.8 m/s. **Calculate** the frequency of oscillation, if its amplitude is 0.5 m.	**5**	Applying K3	**CO1**
Sol	Formula: $v_{max} = \omega A$ $\therefore \omega = 125.6$ rad/s $\omega = 2\pi f$ $\therefore f = 20$ Hz	**1** **1** **1** **2**		
(c)	**Obtain** one-dimensional time-independent Schrödinger wave equation.	**5**	Applying K3	**CO2**
	Starting from $\psi = Ae^{i(kx-\omega t)}$ upto $\frac{d^2\psi}{dt^2} = Ae^{i(kx-\omega t)}(-\omega^2) = -\omega^2\psi$ using $\lambda = \frac{h}{mv}$ and $\frac{d^2\psi}{dx^2} = \frac{1}{v^2}\frac{d^2\psi}{dt^2}$ Arrive upto $\frac{d^2\psi}{dx^2} + \frac{8\pi^2 m}{h^2}(E-V)\psi = 0$	**1** **1** **1** **2**		
	OR			

2(a)	**Define** spring constant. **Derive** the expressions for equivalent force constant for two springs in parallel combination.	**5**	Applying K3	**CO1**
Sol	Definition of spring constant Diagram: Starting from $F_p = -k_p x$, Using $F_p = F_1 + F_2$ Arrive at $k_p = k_1 + k_2$	**1** **1** **1** **1** **1**		
(b)	A vibration system of natural frequency 500 cycles/second is forced to vibrate with a periodic force/unit mass of amplitude $100\text{x}10^{-5}$ N/kg in the presence of a damping/unit mass of 0.01×10^{-3} rad/s. **Calculate** the maximum amplitude of vibration of the system.	**5**	Applying K3	**CO1**
Sol	Formula: b = r/2m $\therefore$ b = $0.005\text{x}10^{-3}$ $A_{max} = \frac{\frac{F}{m}}{2bp}$ But $\omega = 2\pi f$ $\therefore A_{max} = 0.0318$m	**1** **1** **1** **2**		
(c)	**Solve** the Schrödinger's wave equation for the allowed energy values in the case of a particle in a box.	**5**	Applying K3	**CO2**
Sol	Starting from Schrodinger's wave equation $\frac{d^2\psi}{dx^2} + \frac{8\pi^2 m}{h^2}(E-0)\psi = 0$ Arrive upto $\frac{d^2\psi}{dx^2} + K^2\psi = 0$ and Ψ = A cos Kx + B sin Kx Again applying boundary conditions, Arrive upto $E = \frac{n^2h^2}{8ma^2}$	**1** **1** **1** **2**		
	PART-B			
3(a)	**Obtain** the theory of damped oscillations.	**5**	Applying K3	**CO1**
Sol	Starting from $Restoring\ force = -kx, resistive\ force = -r\frac{dx}{dt}$ $and\ m\frac{d^2x}{dt^2} = -r\frac{dx}{dt} - kx$ Arrive upto $\frac{d^2x}{dt^2} + 2b\frac{dx}{dt} + \omega^2 x = 0$ Using $x = Ae^{\alpha t}$ by differentiating Arrive at $x = A_1 e^{(-b+\sqrt{b^2-\omega^2})t} + A_2 e^{(-b-\sqrt{b^2-\omega^2})t}$	**1** **1** **1** **2**		
(b)	**Describe** the construction & working of Reddy shock tube with the help of a diagram.	**5**	Understand K2	**CO1**
Sol	Diagram Construction of Shock tube Working of shock tube	**1** **2** **2**		

(c)	**Show that** an electron cannot exist within the nucleus of an atom.	**5**	Applying K3	**CO2**
Sol	Starting from $E = \frac{p^2}{2m}$ Using $\Delta x_{max} = 10^{-14}m$, $obtain\ \Delta p_{min} = 0.5 \times 10^{-20} kg\ m/s$ Finally arrive at $E = 85MeV$ Conclude using the concept of radioactive decay	**1** **2** **1** **1**		
	OR			
4(a)	**Obtain** an expression for amplitude of vibration of a body undergoing forced oscillations.	**5**	Applying K3	**CO1**
Sol	Starting from $Restoring\ force = -kx, resistive\ force = -r\frac{dx}{dt},$ $External\ periodic\ force = F\ sinpt$ $and\ m\frac{d^2x}{dt^2} = -r\frac{dx}{dt} - kx + Fsinpt$ Arrive upto $\frac{d^2x}{dt^2} + 2b\frac{dx}{dt} + \omega^2 x = F\sin pt$ Using $x = Asin(pt - \theta)$ Arrive at $A = \frac{F/m}{\sqrt{(\omega^2 - p^2)^2 + 4b^2p^2}}$	**2** **1** **2**		
(b)	**Explain** the basic of conservation of mass, momentum and energy.	**5**	Understand K2	**CO1**
Sol	Explanation: Three Conservation laws with statement and equation: Conservation of mass and equation Conservation of momentum and equation Conservation of energy and equation	**1** **2** **2**		
(c)	In a measurement of position and velocity of an electron moving with a speed of 6×10^5 *m/s*, **calculate** the highest accuracy with which its position could be determined if the inherent error in the measurement of its velocity is 0.01% for the speed stated.	**5**	Applying K3	**CO2**
Sol	$\Delta v = 6\times10^5$ x(0.01/100) = 60m/s $\Delta p = m\ \Delta v = 5.46 \times 10^{-29}$ kg m/s $\Delta x \geq \frac{h}{4\pi.\Delta p}$ $\therefore \Delta x = 9.65\text{x } 10^{-7}$ m	**1** **1** **1** **2**		

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K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109

DEPARTMENT OF SCIENCE AND HUMANITIES

II SESSIONAL TEST QUESTION PAPER 2019 – 2020 ODD SEMESTER

SET-A

USN | | | | | | | | | |

Degree	:	**B.E**	**Semester**	:	**I**
Branch	:	**CSE/C.V/EEE**	**Date**	:	**24-10-2019**
Course Title	:	**Engineering Physics**	**Course Code**	:	**18PHY12**
Duration	:	**90 Minutes**	**Max Marks**	:	**30**

Constants: *charge on an electron $e=1.6\times10^{-19}C$, Planck's constant, $h=6.625\times10^{-34}Js$, velocity of light $c=3\times10^{8}m/s$, mass of an electron, $m=9.1\times10^{-31}kg$, Boltzmann constant $k=1.38\times10^{-23}J/K$*

Note: Answer ONE full question from each part

Q. No.	Questions	Marks	K Level	CO mapping
	PART-A			
1(a)	**Derive** the expression for energy density of radiation in terms of Einstein's coefficients.	5	Applying K3	CO2
(b)	**Explain** the assumptions made in quantum free electron theory?	5	Understand K2	CO3
(c)	**Derive** the expression for Fermi energy in terms of energy gap of an intrinsic semiconductor.	5	Applying K3	CO3
	OR			
2(a)	A medium in thermal equilibrium at temperature $300K$ has two energy levels with a wavelength separation of $1\mu m$. **Find** the ratio of population densities of the upper and lower levels.	5	Applying K3	CO2
(b)	**Explain** the variation of Fermi factor with temperature and energy.	5	Understand K2	CO3
(c)	**Derive** an expression for Fermi energy at Zero Kelvin.	5	Applying K3	CO3
	PART-B			
(a)	**Explain** the construction and working of CO_2 laser with the help of energy level diagram.	5	Understand K2	CO2
(b)	**Explain** density of states and fermi factor with equation.	5	Understand K2	CO3
(c)	**Calculate** the probability of an electron occupying an energy level $0.02eV$ above the fermi level at $400K$ in a material.	5	Applying K3	CO3
	OR			
4(a)	**Explain** with energy band diagram the construction and working of semiconductor diode laser.	5	Understand K2	CO2
(b)	**Explain** any 2 major success of quantum free electron theory.	5	Understand K2	CO3
(c)	**Derive** an expression for electrical conductivity of a semiconductor.	5	Applying K3	CO3

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K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109

DEPARTMENT OF Science and Humanities

II SESSIONAL TEST SCHEME & SOLUTION 2018 – 19 ODD SEMESTER

SET-A

USN										

Degree	:	**B.E**	**Semester**	:	**I**
Branch	:	**CSE/EEE/CIVIL**	**Date**	:	**24-10-2019**
Course Title	:	**Engineering Physics**	**Course Code**	:	**18PHY12**
Duration	:	**90 Minutes**	**Max Marks**	:	**30**

Note: Answer ONE full question from each part

Q. No.	Questions with Scheme & Solution	Marks	K Level	CO mapping
	PART-A			
1(a)	**Derive** the expression for energy density of radiation in terms of Einstein's coefficients.	5	Applying K3	CO2
Sol	Starting from $E_\nu N_1 B_{12} = N_2 A_{21} + E_\nu N_2 B_{21}$ Using $\frac{N_1}{N_2} = e^{\frac{h\nu}{kt}}$ Obtain $E_\nu = \frac{A_{21}}{B_{21}\left[\frac{B_{12}}{B_{21}} e^{\frac{h\nu}{kt}} - 1\right]}$ Comparing Planck's equation $E_\nu = \frac{8\pi h\nu^3}{c^3}\left[\frac{1}{e^{\frac{h\nu}{kt}} - 1}\right]$ Arrive at $\frac{A_{21}}{B_{21}} = \frac{8\pi h\nu^3}{c^3}$, $B_{12} = B_{21}$, $E_\nu = \frac{A}{B\left[e^{\frac{h\nu}{kt}} - 1\right]}$	1 + 1 + 1 + 1 + 1	Applying K3	CO2
(b)	**Explain** the assumptions made in quantum free electron theory?	5	Understand K2	CO3
Sol	4 Assumptions: Keywords: Quantization, Pauli's exclusion principle, potential, attractive force and repulsive force	4 + 1	Understand K2	CO3
(c)	**Derive** the expression for Fermi energy in terms of energy gap of an intrinsic semiconductor.	5	Applying K3	CO3
Sol	**Starting from:** $N_e = N_h$ **equating** $(m_e^*)^{3/2} e^{(E_F - E_g)/KT} = (m_e^*)^{3/2} e^{(-E_F)/KT}$	1 + 1 + 3	Applying K3	CO3

	Arrive at $E_F = \frac{1}{2}E_g$			
2(a)	A medium in thermal equilibrium at temperature $300K$ has two energy levels with a wavelength separation of $1\mu m$. **Find** the ratio of population densities of the upper and lower levels.	5	Applying K3	CO2
Sol	Formula: $\frac{N_2}{N_1} = e^{\frac{-hc}{\lambda KT}}$ Substitution Answer: $\frac{N_2}{N_1} = 1.365\text{x}10^{-21}$	1 + 3 + 1	Applying K3	CO2
(b)	**Explain** the variation of Fermi factor with temperature and energy.	5	Understand K2	CO3
Sol	Explanation of 3 cases: Formula $E < E_F, T = 0K$ $E > E_F, T = 0K$ $E = E_F, T > 0K$ Representation of graph	1 + 1 + 1 + 1 + 1	Understand K2	CO3
(c)	**Derive** an expression for Fermi energy at Zero Kelvin.	5	Applying K3	CO3
Sol	Starting from $N(E)dE = g(E)\,dEXf(E)$ Using $n = \int_{E=0}^{E_{max}} g(E)dE \text{ x } 1$ Arrive at $E_{F_0} = Bn^{2/3}$	1 + 2 + 3	Applying K3	CO3
	PART-B			
3(a)	**Explain** the construction and working of CO_2 laser with the help of energy level diagram.	5	Understand K2	CO2
Sol	Diagram: Explanation of : Construction Working: Transitions in Energy levels of CO_2 laser	1 + 2 + 2	Understand K2	CO2
(b)	**Explain** density of states and fermi factor with equation.	5	Understand K2	CO3
Sol	Explanation: Equations $g(E)dE = \left[\frac{8\sqrt{2}\,\pi m^{3/2}}{h^3}\right] E^{1/2}\,dE$	2 + 2	Understand K2	CO3

	$f(E) = \frac{1}{e^{\left(\frac{E-E_F}{KT}\right)} + 1}$		1	
(c)	**Calculate** the probability of an electron occupying an energy level $0.02eV$ above the fermi level at $400K$ in a material.	5	Applying K3	CO3
Sol	Formula: $f(E) = \frac{1}{e^{\left(\frac{E-E_F}{KT}\right)}+1}$ Substitution $E - E_F = 0.02eV$ Answer: $f(E) = 0.36$	1 + 3 + 1	Applying K3	CO3
4(a)	**Explain** with energy band diagram the construction and working of semiconductor diode laser.	5	Understand K2	CO2
Sol	Diagram: Explanation of : Construction & Working: Explanation of Fermi levels in P-type and N-type semi-conductor diode laser and recombination of electrons and holes resulting in emission of laser radiation.	1 + 2 + 2	Understand K2	CO2
(b)	**Explain** any 2 major success of quantum free electron theory.	5	Understand K2	CO3
Sol	Explanation of dependence of conductivity on temperature and dependence of conductivity on electron concentration	2 + 3	Understand K2	CO3
(c)	**Derive** an expression for electrical conductivity of a semiconductor.	5	Applying K3	CO3
Sol	Starting from $I = nevA$ Using $\mu_e = v/E$ and $J = \sigma E$ Arrive at $\sigma = e(N_e\mu_e + N_h\mu_h)$ and further for intrinsic semiconductor $\sigma = n_i\, e(\mu_e + \mu_h)$	1 + 1 + 3	Applying K3	CO3

24/10

Course In charge

24/10/2019.

Head - Dept

K. Rama

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K. S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE-560109
DEPARTMENT OF SCIENCE AND HUMANITIES
III SESSIONAL TEST QUESTION PAPER 2018 – 19 ODD SEMESTER

SET-A

USN | | | | | | | | | |

Degree	: **B.E**	**Semester**	: **I**
Branch	: CSE / CV / EEE	**Date**	: **9-12-2019**
Course Title	: **Engineering Physics**	**Course Code**	: **18PHY12**
Duration	: **90 Minutes**	**Max Marks**	: **30**

Constants: *Charge of an electron $e = 1.6\times10^{-19}C$, Planck's constant $h = 6.625\times10^{-34}Js$, velocity of light c=3x10^{8}m/s, mass of an electron $m = 9.1\times10^{-31}kg$*

Note: Answer ONE full question from each part

Q. No.	Question	Marks	K Level	CO mapping
	PART-A			
1(a)	**Explain** Young's modulus and Bulk modulus of elasticity.	5	Understand K2	CO4
(b)	**Derive** the relation between K, Y and σ.	5	Applying K3	CO4
(c)	**Obtain** an expression for the numerical aperture.	5	Applying K3	CO5
	OR			
2(a)	**State** and **explain** Hooke's law with the help of stress-strain diagram.	5	Understand K2	CO4
(b)	**Derive** the expression for bending moment in terms of moment of inertia.	5	Applying K3	CO4
(c)	**Calculate** the V-number for a fiber of core diameter 40μm and with refractive indices of 1.55 and 1.50 respectively for core and cladding when the wavelength of the propagating wave is 1400nm. Also **calculate** the number of modes that the fiber can support for propagation. Assume that the fiber is in air.	5	Applying K3	CO5
	PART-B			
3(a)	**Derive** the relation between K, η and Y.	5	Applying K3	CO4
(b)	**Calculate** the torque required to twist a wire of length 1.5m, radius 0.0425x10^{-2}m, through an angle (π/45) radian, if the value of rigidity modulus of its material is 8.3x10^{10}N/m^2.	5	Applying K3	CO4
(c)	**Discuss** the point to point communication using an optical fiber with the help of a block diagram.	5	Understand K2	CO5
	OR			
4(a)	**Derive** an expression for couple per unit twist of a solid cylinder.	5	Applying K3	CO4
(b)	**Calculate** the extension produced in a wire of length 2m and radius 0.013x10^{-2}m due to a force of 14.7N applied along its length. Given, Y=2.1x10^{11}N/m^2	5	Applying K3	CO4
(c)	**Explain** the different types of optical fibers with suitable diagrams.	5	Understand K2	CO5

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K. S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE-560109
DEPARTMENT OF SCIENCE AND HUMANITIES

III SESSIONAL TEST SCHEME & SOLUTION 2018 – 19 ODD SEMESTER

SET-A

USN | | | | | | | | | | |

Degree	**: B.E**	**Semester**	**: I**
Branch	**: Science and Humanities**	**Date**	**: 9-12-2019**
Course Title	**: Engineering Physics**	**Course Code**	**: 18PHY12**
Duration	**: 90 Minutes**	**Max Marks**	**: 30**

Constants: *Charge of an electron $e = 1.6\times10^{-19}C$, Planck's constant $h = 6.625\times10^{-34}Js$, velocity of light $c=3\times10^{8}m/s$, mass of an electron $m = 9.1\times10^{-31}kg$*

Note: Answer ONE full question from each part

Q. No.	Question	Marks	K Level	CO mapping
	PART-A			
1(a)	**Explain** Young's modulus and Bulk modulus of elasticity.	**5**	Understand K2	**CO4**
Sol	Diagram Definition of Young's modulus Expression for Young's modulus Definition of Bulk modulus Expression for Bulk modulus	**1** **1** **1** **1** **1**		
(b)	**Derive** the relation between K, Y and σ.	**5**	Applying K3	**CO4**
Sol	Diagram Starting from Final length along X-direction = $1 + \alpha T_x - \beta T_y - \beta T_z$ Using $T_x = T_y = T_z = T$ Arrive upto Volume strain = $\frac{3T(\alpha-2\beta)}{1}$ Using Bulk modulus, $K = \frac{\text{volume stress}}{\text{volume strain}}$ Arrive at $K = \frac{Y}{3(1-2\sigma)}$	**1** **1** **1** **1** **1** **1**		
(c)	**Obtain** an expression for the numerical aperture.	**5**	Applying K3	**CO5**
Sol	Diagram Starting from Snell's law $n_o \sin\theta_o = n_1 \sin\theta_1$ Arrive upto $\cos\theta_1 = \frac{n_2}{n_1}$ Rewriting and substituting for $\cos\theta_1$, arrive upto N.A. = $\sqrt{n_1^2 - n_2^2}$	**1** **2** **2**		
	OR			

2(a)	**State** and **explain** Hooke's law with the help of stress-strain diagram.	5	Understand K2	CO4
Sol	Diagram Statement of Hooke's law Explanation	1 1 3		
(b)	**Derive** the expression for bending moment in terms of moment of inertia.	5	Applying K3	CO4
Sol	Diagram Starting from Arc length CD = Rθ Arrive upto Linear strain = r/R Using $Y = \frac{\text{longitudinal stress}}{\text{longitudinal strain}}$ Arrive upto $F = \frac{YAr}{R}$ Again starting from Moment of force = F x its distance from neutral axis Arrive at Bending moment = $\frac{Y}{R} I_g$	1 1 1 2		
(c)	**Calculate** the V-number for a fiber of core diameter 40μm and with refractive indices of 1.55 and 1.50 respectively for core and cladding when the wavelength of the propagating wave is 1400nm. Also **calculate** the number of modes that the fiber can support for propagation. Assume that the fiber is in air.	5	Applying K3	CO5
Sol	Formula: $V = \frac{\pi d}{\lambda}\sqrt{n_1^2 - n_2^2}$ $\therefore V = 35$ Number of modes $\approx V^2/2$ $\therefore$ Number of modes = 612	1 2 1 1		
	PART-B			
3(a)	**Derive** the relation between K, η and Y.	5	Applying K3	CO4
Sol	Starting from $Y = 2\eta(1 + \sigma)$ Using $K = \frac{Y}{3(1-2\sigma)}$ Arrive upto $Y = \frac{9\eta K}{3K + \eta}$	1 1 3		
(b)	**Calculate** the torque required to twist a wire of length 1.5m, radius 0.0425×10^{-2}m, through an angle (π/45) radian, if the value of rigidity modulus of its material is 8.3×10^{10}N/m^2.	5	Applying K3	CO4
Sol	Formula: $C = \frac{\pi\eta R^4}{2L}$ $\therefore C = 2.836 \times 10^{-3}$ $\tau = C\theta$ $\therefore \tau = 1.98 \times 10^{-4}$Nm	1 1 1 2		

(c)	**Discuss** the point to point communication using an optical fiber with the help of a block diagram.	5	Understand K2	CO5
Sol	Block Diagram Explanation	2 3		
	OR			
4(a)	**Derive** an expression for couple per unit twist of a solid cylinder.	5	Applying K3	CO4
Sol	Diagram Starting from $\angle BXB` = \phi$ Arrive upto $\phi = r\theta/L$ Using $A = 2\pi rdr$ and η = shearing stress/shearing strain Arrive upto Moment of force $= \frac{2\pi\eta\theta}{L} r^3 dr$ Again starting from twisting couple $= \int_{r=0}^{r=R} \frac{2\pi\eta\theta}{L} r^3 dr$ Arrive upto $C = \frac{\pi\eta R^4}{2L}$	1 1 1 2		
(b)	**Calculate** the extension produced in a wire of length 2m and radius 0.013×10^{-2}m due to a force of 14.7N applied along its length. Given, $Y=2.1\times10^{11}N/m^2$	5	Applying K3	CO4
Sol	Formula: $A = \pi r^2$ $\therefore A = 5.31\times10^{-8}m^2$ $\Delta L = \frac{FL}{AY}$ $\therefore \Delta L = 2.6\times10^{-3}m$	2 2 1		
(c)	**Explain** the different types of optical fibers with suitable diagrams.	5	Understand K2	CO5
Sol	3 types of optical fibers Diagram Explanation for each type of optical fiber	2 3		

2/12/19
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