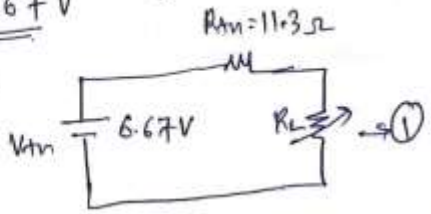
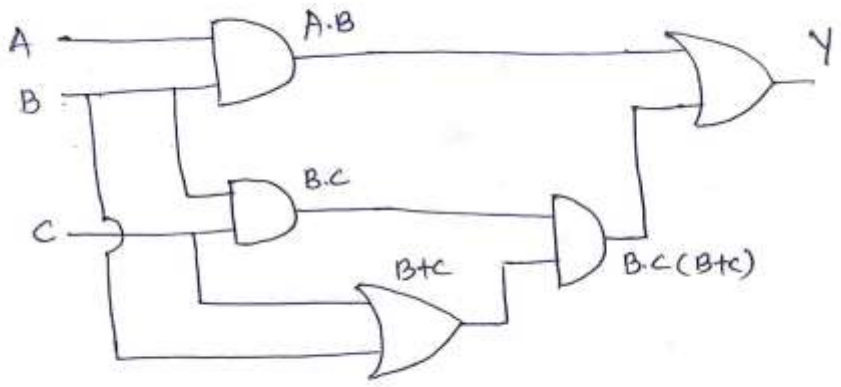
SEM-II	F. Y. B. Sc PHYSICS – II	100 MARKS 3 HRS

Q.1	**(A)**	**Select the correct option :**	12
	i)	(b) inductance	
	ii)	(a) Hay's	
	iii)	(a) 40 %	
	iv)	(c) 0.5	
	v)	(d) all of the above	
	vi)	(b) are zero	
	(B)	**Answer in one sentence :**	03
	i)	Since the balancing condition of Wien's bridge depends on the angular frequency, therefore it's source must be a pure sinusoidal?	
	ii)	PIV (peak inverse voltage) rating of a diode is the maximum voltage applied to the diode without damaging it.	
	iii)	Electric potential is potential energy per unit charge.	
	(C)	**Fill in the blanks**	05
	i)	Phasor	
	ii)	Q-factor or Q value	
	iii)	Infinite	
	iv)	A	
	v)	Constant	
Q.2	**(A)**	**Attempt any one**	08
	i)	Circuit diagram of series C-R circuit----------(2) Finding the phasor voltages----------(2) Obtaining the impedance of the circuit----------(2) Phasor Diagram----------(2)	
	ii)	Explanation of AC bridge----------(2) Obtaining the conditions required to balance AC bridge----------(4) Diagram of Maxwell's LC bridge----------(2)	
	(B)	**Attempt any one**	08
	i)	Circuit diagram of series L-C-R combination----------(2) Derivation for impedance of the circuit----------(3) Expression for phase difference between the current and the voltage----(1) Phasor diagrams for voltage in LCR circuit----------(2)	
	ii)	Circuit diagram and explanation of Wein's bridge----------(3) Obtaining balance condition for Wein's bridge----------(4) Formula for angular frequency----------(1)	

	(C)	**Attempt any one**	04
	i)	$V_{max} = V_{cc} = 15V$, $\omega = 100\pi$, $R = 5\Omega$, $L = 10mH$ Reactance of Inductor $X_L = 2\pi fL = \omega L$ → (2) $\therefore X_L = 100\pi \times 10 \times 10^{-3}\ \Omega$ $\boxed{X_L = 3.14\ \Omega}$ Impedance of the circuit $\|Z^*\| = \sqrt{R^2 + X_L^2}$ → (1) $\therefore \|Z^*\| = 5.9\ \Omega$ $I_{rms} = \frac{V_{rms}}{\|Z^*\|} = \frac{V_{max}}{\sqrt{2}\|Z^*\|} = \frac{15}{8.34} = 1.80\ A$ → (1)	
	ii)	$R_2 = 2.2K\Omega$, $R_4 = 1K\Omega$, $C_3 = 0.1\mu F$ Balance condition of de Sauty's bridge is → (1) $\frac{C_1}{C_3} = \frac{R_4}{R_2}$ $\therefore C_1 = \frac{R_4}{R_2} \times C_3 = \frac{1}{2.2} \times 0.1 \times 10^{-6} = 0.045 \times 10^{-6}\ F$ → (2) $\therefore \boxed{C_1 = 0.045\ \mu F}$ The value of other capacitance needed to balance bridge is 0.045 μF → (1)	
Q.3	(A)	**Attempt any one**	08
	i)	Diagram of a bridge full wave rectifier----------(2) Explanation during positive half cycle ----------(3) Explanation during negative half cycle ----------(3)	
	ii)	Electronic adder explanation----------(2) Full adder logical circuit with explanation----------(3) Verifying its truth table----------(3)	
	(B)	**Attempt any one**	08
	i)	Statement of reciprocity theorem----------(1) Explanation with the help of network circuit----------(2) Finding the value of I_{L1}----------(2) Finding the value of I_{L2}----------(2) Conclusion----------(1)	
	ii)	Explanation of zener diode----------(2) Circuit diagram for zener diode as voltage regulator----------(2) Discussing the circuit for input voltage greater than or less than zener voltage -----(4)	
	(C)	**Attempt any one**	04

	i)	$R_{th} = \frac{R_1 R_2}{R_1+R_2} + R_3 = \frac{10\times 5}{10+5} + 8 = 11.33\,\Omega$ → (1) for V_{th}, $I = \frac{V}{R_1+R_2} = \frac{20}{15} = 1.33\ A$ → (2) $\therefore V_{th} = I R_2 = 1.33 \times 5 = 6.67\ V$ ∴ Thevenin equivalent circuit is 	
	ii)	$V_{in} = 50V$, Series resistance $R = 1K\Omega$, load resistance $= 2.2K\Omega$ $V_z = 25V$ Voltage across series resistance R, $V_R = V_{in} - V_z = 50-25 = 25V$ → (1) current through series resistance R is $I_R = \frac{V_R}{R} = \frac{25V}{1K\Omega} = 25mA$ → (1) $\because V_z = V_L = 25V$ $\therefore I_L = \frac{V_L}{R_L} = \frac{25V}{2.2K\Omega} = 11.36\ mA$ → (1) we have, $I_R = I_z + I_L$ $\therefore I_z = I_R - I_L = 25 - 11.36 = 13.64\ mA$ → (1)	
Q.4	(A)	**Attempt any one**	08
	i)	Expression for discrete charge distribution----------(2) Explanation of linear charge distribution----------(2) Explanation of surface charge distribution----------(2) Explanation of volume charge distribution----------(2)	
	ii)	Construction of Helmholtz coil with diagram----------(2) Obtaining the magnetic field produced by it----------(2) Finding its value at midpoint of the line joining the centres-----(2) Explaining the magnetic field with the help of graph----------(2)	
	(B)	**Attempt any one**	08
	i)	Assumption of point charges distribution ----------(2) Finding the work done to bring the charges----------(4) Conclusion----------(2)	
	ii)	Explaining the solenoid----------(2) Obtaining the magnetic field of current carrying solenoid----------(2) Proving the value at the end is half the field at a point well inside--------(2) Plot of the magnetic field along the axis of solenoid----------(2)	

	(C)	**Attempt any one**	04
	i)	let $q_0 = 1C$, $q_1 = 2\mu C$, $q_2 = 3\mu C$, $q_3 = 5\mu C$ → (1) $x_1 = 2cm$, $x_2 = 3cm$, $x_3 = 5cm$ Using superposition Principle, $F = \frac{q_0}{4\pi\varepsilon_0}\left[\frac{q_1}{r_1^2} + \frac{q_2}{r_2^2} + \frac{q_3}{r_3^2}\right]$ → (1) $= 9\times10^9 \times 1 \times \left[\frac{2}{4} + \frac{3}{9} + \frac{5}{25}\right]\frac{\times10^{-6}}{\times10^{-4}}$ → (1) $F = 9.27\times10^7\ N$ → (1)	
	ii)	For straight long conductor carrying current, $B = \frac{\mu_0 I}{2\pi x}$ → (2) Here, $I = 12\ A$, $x = 25\ cm = 25\times10^{-2}\ m$ $\therefore B = \frac{\mu_0}{4\pi}\times\frac{2I}{x} = 10^{-7}\times\frac{2\times12}{25\times10^{-2}} = 0.96\times10^{-5}\ Wb$ → (2) $\therefore B = 0.96\times10^{-5}\ Wb.$	
Q.5	**Attempt any four**		20
	i)	Statement of Superposition theorem----------(2) Basic steps for solving a network circuit----------(3)	
	ii)	Y = A.B + B.C (B+C)  ---(5)	
	iii)	Importance of capacitor as a filter----------(2) Explanation with the help of graph----------(3)	
	iv)	Explanation of EX-OR gate----------(2) It's construction using basic gates----------(3)	

	v)	Discussion of electric field----------(2) Obtaining expression in terms of force and charge--------(3)	
	vi)	Statement of Biot-Savarts law----------(2) It's explanation----------(3)	
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