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W.P. Code 67976

SEM-IV

S. Y. B. Sc  
PHYSICS - I

100 MARKS 3 HRS

- Note: 1) All questions are compulsory.  
 2) Use of non-programmable calculator is allowed.  
 3) Draw figures wherever necessary.  
 4) Symbols have their usual meanings unless mentioned.

Q.1	(A) Select the correct option	12
	i) (C) 90	
	ii) (b) Wein	
	iii) (b) Ex-OR, AND	
	iv) (c) equal to load	
	v) (a) $Q.V$	
	vi) (d) radius	
	(B) Answer in one sentence :	03
	i) LCR parallel circuit rejects frequency $\omega_0$ and close to it ie frequencies in bandwidth and so called as rejecter circuit.	
	ii) Efficiency of a rectifier is defined as the ratio of dc output power delivered to the load the ac input power received. ....01	
	iii) The magnitude of electric field on the equipotential surface is zero.	
	(C) Fill in the blanks	05
	i) $\omega L$ or $2\pi fL$	
	ii) infinite	
	iii) Ex-OR	
	iv) 0.48	
	v) Volt or joule/coulomb	
Q.2	(A) Attempt any one	08
	i) Series LR circuit diagram 1m Derivation for i and v and show I lags behind v by angle $\theta$ 6m phasor diagram. 2m	
	ii) Instantaneous power dissipated by an ac circuit - derivation 4m True power - Defination 1m Derivation - true power 3m	
	(B) Attempt any one	08
	i) Maxwell LC bridge - diagram 2m Balancing conditions - derivation 6m	
	ii) De Sauty's bridge - diagram 2m Balancing condition - derivation 5m Application 1m	
	(C) Attempt any one	04

	i)	Given : $f_0 = 10 \text{ KHz}$ , $\omega L$ or $2\pi f_0 L = 200\Omega$ , $R = 10\Omega$ $L = \omega L = 200/(2\pi f_0) = 3.184 \text{ mH}$ Bandwidth = $(1/2\pi)(R/L) = 500.74 \text{ Hz}$	2m 2m	
	ii)	Given : $R = 470\Omega$ and $C = 0.1\mu\text{F}$ Frequency of ac source = $1/(2\pi RC)$ $= 3.387 \text{ KHz}$	2m 2m	
Q.3	(A)	Attempt any one		08
	i)	Thevenin's theorem - statement Proof, ie derivation	2m 6m	
	ii)	Binary adders : To add binary numbers, the circuits that are used are called as binary adders. The process of addition involves sum of like significant bits. Full adder : Circuit diagram and logic symbol Explanation Truth-table	2m 2m 2m 2m	
	(B)	Attempt any one		08
	i)	circuit diagram Working Waveforms	2m 3m 3m	
	ii)	De Morgan's law 1 (complement of sum)- statement in words and mathematical equation, logic diagram, truth-table Same for law 2 (complement of product)	4m 4m	
	(C)	Attempt any one		04
	i)	$Y = (A+B).(A+C)$ simplify to $Y = A+BC$ Logic diagram for simplified RHS of expression	2m 2m	
	ii)	$V_z = 7.2 \text{ V}$ , $R_L = 5\text{k}\Omega$ , $V_{in} = 12 \text{ V}$ , $R_S = 1\text{k}\Omega$ Voltage drop across $R_S = V_{in} - V_z = 12 - 7.2 = 4.8 \text{ V}$ Current through $R_S$ ie $I_{R_S} = (V_{R_S}/R_S) = (4.8/1 \times 10^3) = 4.8 \text{ mA}$ Current through $R_L$ ie $I_L = (7.2 / 5 \times 10^3) = 1.44\text{mA}$ Current through Zener ie $I_z = (I_{R_S} - I_L) = (4.80 - 1.44)\text{mA}$ $= 3.36 \text{ mA}$	1m 1m 1m 1m	
Q.4	(A)	Attempt any one		08
	i)	The potential energy stored in a system of N discrete point charges- Expression for work done for appoint charge - Energy U in assembling N charges is obtained by summing up individual works done in bringing one at a time - U in terms of potential	3m 3m 3m 2m	
	ii)	Electric field in terms of electric potential - explanation 4 comments on the potential -	4m 4m	
	(B)	Attempt any one		08
	i)	Expression for the magnetic field long finite wire - diagram derivation modification for infinitely long wire -	2m 5m 1m	
	ii)	Solenoid is a series of uniform turns of wire wound on a cylindrical surface, diagram	3m	

	Derivation for expression for the magnetic field at a point well inside solenoid	5m	
(C)	Attempt any one		04
i)	Given : $E = (2xi - 4yj)$ , let A(2,0) and B(0,2), $Q = +1$ C $dr = i dx + j dy$ $W = -Q \int_A^B E \cdot dr$ $= 12$ J	1m 3m	
ii)	Given : $N = 30$ , $I = 0.5$ A, $D = 0.1$ m, $\mu_0 = 4\pi \times 10^{-7}$ N/A <sup>2</sup> $B = \mu_0 NI / 2R$ $= 8.84 \times 10^{-7}$ Wb/m <sup>2</sup>	1m 3m	
Q.5	Attempt any four		20
i)	$V_{max} = 200$ V, $\omega = 100$ rad/sec, $C = 1\mu$ F, $R = 10$ K $\Omega$ P.D. across C, $V_{cmax} = c \cdot I_{max} = (1/\omega C) \cdot (V_{max}/Z)$ $= 141.4$ V	2m 3m	
ii)	Given: $R_2 = 900\Omega$ , $R_3 = 1000\Omega$ , $R_4 = 2700\Omega$ and $C = 0.47\mu$ F $L = R_2 R_3 C$ $= 0.423$ H $R = R_2 R_3 / R_4$ $= 333.3 \Omega$	1m 2m 1m 1m	
iii)	Maximum power = $(V_{th})^2 / 4R_{th}$ $= (5 \times 5) / (4 \times 1 \times 10^3)$ $= 6.25$ mW	2m 1m 2m	
iv)	NAND gate is called as universal building block because all basic gates are constructed using only NAND gate. AND, OR, NOT using only NAND	2m 3m	
v)	Biot-Savrot law, statement Explanation	2m 3m	
vi)	Spherical shell-electrostatic potential at a point P (i) outside (ii) inside the shell.	2m 3m	
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