<table>
<tr><td colspan="4" align="center">SECTION A
(5Qx4M=20Marks)</td></tr>
</table>

S. No.		Marks	CO

Q 1	(i) Which of these is a property of Laser.
	    (a) Monochromatic (b) Directional (c) Coherent (d) All of the above
	
	(ii) Isobars are those which have
	    (a) Same number of neutrons (b) Same mass number
	
	(iii) Which of the following conservation principle is violated during pair production?
	
	    (a) Momentum
	    (b) Energy
	    (c) Charge
	    (d) None of the above
	
	(iv) Matter waves are………………..in nature.
	    (a) electromagnetic (b) non-electromagnetic
		4	**CO1**

Q 2	Explain Wu's experiment to demonstrate that parity is violated in weak interactions.	**4**	**CO2**
Q 3	Calculate the de Broglie wavelength of a proton which is moving with a kinetic energy of 1000 eV.	**4**	**CO3**
Q 4	Out of protons, electrons and neutrons which is the most suitable probe to study properties of nucleus and why?	**4**	**CO2**

Q 5	Based on the law of conservation of baryon number, which of the following reactions can occur? (i) $\pi^- + p \rightarrow \pi^0 + n + \pi^- + \pi^+$ (ii) $\pi^- + p \rightarrow \Lambda^0 + K^0$	4	CO4

SECTION B
(4Qx10M= 40 Marks)

Q 6	Establish a relation between Einstein's A and B coefficients.	10	CO2
Q 7	The stability of Cl (A = 36, Z = 17) with respect to alpha, beta-plus, and beta-minus decay is to be determined. Do not consider the possibility of decay by electron capture. The following atomic masses are known: ^4_2He 4.002603 $^{32}_{15}P$ 31.973907 $^{36}_{16}S$ 35.967081 $^{36}_{17}Cl$ 35.968307 $^{36}_{18}Ar$ 35.967546 The Cl (A = 36, Z = 17) nuclide is: (a) subject to beta-plus decay only (b) subject to beta-minus decay only (c) subject to alpha decay only (d) not subject to alpha, beta-plus, or beta-minus decay (e) subject to beta-plus or beta-minus decay, but not to alpha decay Give reasons in support of your choice.	10	CO4
Q 8	Explain the experimental setup and the evidence Davisson-Germer experiment provided for the wave-particle duality of electrons.	10	CO2
Q 9	Write a brief note on the semi-empirical mass formula inclusive of all terms of binding energy. OR Draw the chart depicting the classification of fundamental particles based upon their spin.	10	CO1

	SECTION-C (2Qx20M=40 Marks)		
Q 10	(a) What do you mean by pair production? Show that pair production can't happen in empty space.	10	CO2
	(b) Explain the Zeeman effect and its manifestation in atomic spectra when influenced by a magnetic field.	10	CO2
Q 11	(a) The wave function for a particle is given by $\varphi(x) = A\cos\left(\frac{2\pi x}{L}\right)$ for $-\frac{L}{4} \le x \le \frac{L}{4}$. Find the probability of finding the particle between $x = 0$ and $x = \frac{L}{8}$.		
	(b) Starting from the momentum conservation equations (in Compton effect) derive a relation between the angle of scattering Ø and angle of recoil θ. $$tan\theta = \frac{\cot\frac{\emptyset}{2}}{1 + \dfrac{hv}{m_o c^2}}$$ where v is the frequency of incident photon and m_0 is the rest mass of the electron.	10	CO2
	OR	10	CO3
	(a) Establish the time dependent Schrodinger wave equation. (b) Light of wavelength 400nm is shone on a metal surface connected to a battery. The work function of the metal is 2.50eV. Find the extinction voltage that is the retarding voltage at which the photoelectron current disappears. Find the speed of the fastest photoelectrons.		

Standard Physics Constants and their values:

Constants	Standard values
Planck's constant (h)	$6.626 \times 10^{-34}\ Js$
Speed of light (c)	$3 \times 10^8\ m/s$
Boltzmann constant (k_B)	$1.38 \times 10^{-23}\ J/K$
Rest mass of an electron (m_0)	$9.11 \times 10^{-31}\ kg$
Charge on electron (e)	$1.6 \times 10^{-19}\ C$
Rest mass of a proton (m_P)	$1.67 \times 10^{-27}\ kg$