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**3 (Sem-5/CBCS) PHY RE 1/2/3/4/5**

**2023**

**PHYSICS**

(Regular Elective)

**Answer the Questions from any one Option.**

**OPTION-A**

Paper : PHY-RE-5016

**(Experimental Techniques)**

**OPTION-B**

Paper : PHY-RE-5026

**(Embedded System :  
Introduction to Microcontrollers)**

**OPTION-C**

Paper : PHY-RE-5036

**(Advance Mathematical Physics-I)**

**OPTION-D**

Paper : PHY-RE-5046

**(Physics of Devices and Instruments)**

**OPTION-E**

Paper : PHY-RE-5056

**(Nuclear and Particle Physics)**

Contd.

**OPTION-A**

Paper : PHY-RE-5016

**(Experimental Techniques)**

Full Marks : 60

Time : Three hours

**The figures in the margin indicate full marks for the questions.**

1. Answer the following questions :  $1 \times 7 = 7$
- (a) What is the number of significant figures in 1.00600 ?
  - (b) What do you mean by 'Noise' in measurement system ?
  - (c) Give the full name of LVDT.
  - (d) What is the function of a transducer ?
  - (e) Mention the value of the phase difference between applied voltage and current in series LCR circuit at resonance.
  - (f) Name a semiconductor type temperature sensor.
  - (g) What is 'electrostatic shielding' ?

2. Answer the following :  $2 \times 4 = 8$
- (a) What are 'S/N ratio' and 'noise figure'? Explain.
  - (b) What is random error ? How is this error minimised ?
  - (c) Explain the principle of a vacuum system.
  - (d) What are RTD and AD590 ?
3. Answer the following : **(any three)**  $5 \times 3 = 15$
- (a) Draw the block diagram of a digital multimeter and mention its working principle.
  - (b) Briefly explain the methods of safety grounding.
  - (c) Using schematic diagram, explain the working of a Pirani gauge.
  - (d) Explain the working of a Q-meter with the help of a circuit diagram.

- (e) A series LCR circuit is connected to 220 V, 50 Hz AC mains, where  $R = 100 \Omega$ ,  $L = 0.5 H$  and  $C = 50 \mu F$ . Calculate the impedance and also the Q-value of the circuit.

4. Answer the following : **(any three)**

$$10 \times 3 = 30$$

- (a) Explain the following terms :  $2 \times 5 = 10$

- (i) Arithmetic mean
- (ii) Average deviation
- (iii) Standard deviation
- (iv) Chi-square test
- (v) Curve fitting

- (b) Establish the differential equation describing the dynamics of a mechanical system. Also draw the frequency response characteristics of a first-order as well as of a second order system.

$$6 + 2 + 2 = 10$$

- (c) Mention different sources of noise in measurement systems. Also explain the following terms :  $2+2+2+2+2=10$

- (i) Inherent fluctuations
- (ii) Thermal noise
- (iii) Shot noise
- (iv)  $1/f$  noise

- (d) What is a diffusion pump ? Explain its working with the help of a diagram. Mention the applications of a diffusion pump.

$$2 + 6 + 2 = 10$$

- (e) (i) Explain the working principle of a linear position transducer.
- (ii) What is a strain gauge ?
- (iii) Two measuring instruments measure the length of a body as 6.7 m and 6.82 m respectively. If the true value of the length is 6.72 m, then which measurement is more accurate and which measurement is more precise ? Explain.

$$5 + 1 + 4 = 10$$

(f) Write short notes : *(any two)*  $5 \times 2 = 10$

- (i) Accuracy and precision
- (ii) Electromagnetic interference shielding
- (iii) RLC bridge
- (iv) Penning gauge

**OPTION-B**

Paper : PHY-RE-5026

**(Embedded System :  
Introduction to Microcontrollers)**

Full Marks : 60

Time : Three hours

**The figures in the margin indicate  
full marks for the questions.**

1. Answer the following questions :  $1 \times 7 = 7$ 
  - (a) Give the full form of RTOS in terms of embedded system.
  - (b) How many memory locations can be addressed by the 16-bit address bus of a 8085 microprocessor ?
  - (c) Mentioned the number of pins are allowed by 8051 microcontroller to connect with I/O devices.
  - (d) Give the total number of instructions available in MCS-51 instruction set.
  - (e) How many timers are there in a 8051 microcontroller ?
  - (f) What is the meaning of MOV A 38H ?
  - (g) What is INT1 in microcontroller 8051 ?

2. Answer the following questions in short :  
2×4=8

- (a) Write a code to send alternating values of 55H and AAH to Port 1.
- (b) Mention the difference between timers and counters in microcontroller.
- (c) Draw a 16×2 LCD pin diagram for a microcontroller.
- (d) How do you define debugging of a program in an embedded system?

3. Answer from the following **either** (a, b & c) or (c, d & e) :  
5×3=15

- (a) What is embedded system and general purpose computer system? Draw the architecture of an embedded system.
- (b) Write a comparative note on data processing and handling in between 8051 microcontroller and 8085 microprocessor.
- (c) What are the different types of addressing modes for addressing the operands in 8051? Mention *three* advantages of usages of Assembly Language in microcontrollers.

- (d) Briefly discuss about the challenges and issues related to design an embedded system.
- (e) Discuss about the program status word of 8051 microcontrollers. What does Cy = 1 mean in 8051?

4. Answer the following : (**any three**)  
10×3=30

- (a) Discuss about the architecture of 8085 microprocessor in detail.
- (b) Give a comparison of 8051 microcontrollers with its other family members. What type of RAM does a 8051 use?  
9+1=10
- (c) Mention the different group of instruction set in the 8051 microcontroller. What is the size of mnemonics of the instruction? Give the description for the following mnemonics – (MOVC, XCH, ADDC, INC, ANL, CLR).  
3+1+6=10
- (d) Mention the key features of microprocessor and microcontrollers. Differentiate 8085 and 8051 in terms of features only.  
4+6=10

- (e) Discuss about the Interrupt Enable Register and Interrupt Priority Register in the 8051. 5+5=10
- (f) Draw the pin diagram of Arduino UNO and mention the specific functions of the pins. Give one example of application of Arduino UNO. 9+1=10

### OPTION-C

Paper : PHY-RE-5036

**(Advance Mathematical Physics-I)**

Full Marks : 60

Time : Three hours

**The figures in the margin indicate full marks for the questions.**

Answer either in English or in Assamese.

1. Answer the following questions : 1×7=7

তলত দিয়া প্ৰশ্নসমূহৰ উত্তৰ দিয়া :

- (a) Define a subspace. Give two examples.

উপস্থানৰ সংজ্ঞা দিয়া। দুটা উদাহৰণ লিখা।

- (b) What do you mean by an isomorphism between two vector spaces  $V$  and  $W$ ?

দুটা ভেক্টৰ স্থান  $V$  আৰু  $W$  ৰ মাজৰ আইচ'মৰ্ফিজিম বুলিলে কি বুজা?

- (c) Give the definition of eigenvalues and eigenvectors of a matrix.

এটা মৌলকম্ৰৰ আইগেনমান আৰু আইগেনভেক্টৰৰ সংজ্ঞা দিয়া।

(d) What is zero order tensor? Give *one* example.

শূন্য ক্রমৰ টেন্চৰ কি? এটা উদাহৰণ দিয়া।

(e) Write down the covariant derivative of tensor  $A_p$ .

$A_p$  টেন্চৰৰ ক'ভেৰিয়েন্ট অৱকলজটো লিখা।

(f) State Cayley-Hamilton theorem of matrix.

মৌল কক্ষৰ কেলি-হেমিল্টন উপপাদ্যটো লিখা।

(g) Write the order of tensor  $C$ , if  $C = a_{pq} a_{rst}$ .

$C = a_{pq} a_{rst}$  টেন্চৰটোৰ ক্রম লিখা।

2. Answer the following questions :  $2 \times 4 = 8$

তলৰ প্ৰশ্নসমূহৰ উত্তৰ দিয়া :

(a) Show that gradient of a scalar field is a covariant tensor of rank 1.

দেখুওৱা যে এখন স্কেলাৰ ক্ষেত্ৰৰ গ্ৰেডিয়েন্ট বেংক 1-ৰ এটা ক'ভেৰিয়েন্ট টেন্চৰ হয়।

(b) Examine whether the following set of vectors are linearly dependent or independent :

$$x_1 = (3, 2, 7), x_2 = (2, 4, 1) \text{ and}$$

$$x_3 = (1, -2, 6)$$

$x_1 = (3, 2, 7), x_2 = (2, 4, 1)$  আৰু  $x_3 = (1, -2, 6)$  ভেক্টৰ তিনিটা বৈখিকভাৱে পৰতন্ত্ৰ নে স্বতন্ত্ৰ পৰীক্ষা কৰা।

(c) Find the second order antisymmetric tensor associated with the vector

$$2\hat{i} - 3\hat{j} + \hat{k}$$

ভেক্টৰ  $2\hat{i} - 3\hat{j} + \hat{k}$  ৰ সৈতে জড়িত হোৱা দ্বিতীয় ক্রমৰ প্ৰতিসমমিত টেন্চৰটো উলিওৱা।

(d) If  $A$  and  $B$  are Hermitian matrices, show that  $(AB + BA)$  is Hermitian and  $(AB - BA)$  is skew-Hermitian.

যদি  $A$  আৰু  $B$  দুটা হাৰমিচিয়ান মৌলকক্ষ হয়, তেনেহলে দেখুওৱা যে  $(AB + BA)$  হাৰমিচিয়ান আৰু  $(AB - BA)$  প্ৰতিহাৰমিচিয়ান হয়।

3. Answer **any three** of the following questions :  
5×3=15

তলত দিয়া প্রশ্নবোৰৰ যিকোনো তিনিটাৰ উত্তৰ দিয়া :

- (a) Give definition of a Group. Prove that the set I of all integers with the binary operation \* defined by  $a*b = a + b + 1$  forms a group. 2+3=5

সংঘৰ সংজ্ঞা দিয়া। দেখুওৱা যে  $a*b = a + b + 1$  ৰ দ্বাৰা বুজোৱা দ্বৈত অপাৰেচন \* ৰ সৈতে সকলো অখণ্ড সংখ্যাৰ সংহতি I য়ে এটা সংঘ গঠন কৰে।

- (b) In a vector space  $V(F)$ , for all  $v \in V$  and  $f \in F$ , prove that

(i)  $0.v = \theta$

(ii)  $f.\theta = \theta$

(iii)  $(-f)v = f(-v) = -(fv)$  2+2+1=5

ভেক্টৰ স্থান  $V(F)$  ;  $v \in V$  আৰু  $f \in F$  ত প্ৰমাণ কৰা যে—

(i)  $0.v = \theta$

(ii)  $f.\theta = \theta$

(iii)  $(-f)v = f(-v) = -(fv)$

- (c) Diagonalize the matrix

$$A = \begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}_{3 \times 3}$$

$$A = \begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}_{3 \times 3}$$

মৌলকক্ষটো ডায়েগ'নেলাইজ

কৰা।

- (d) What is Kronecker delta? Show that it is a mixed tensor of order 2. 1+4=5  
ক্ৰোনেকাৰ ডেল্টা কি? দেখুওৱা যে ক্ৰোনেকাৰ ডেল্টা দ্বিতীয় ক্ৰমৰ এটা মিশ্ৰিত টেন্চৰ।

- (e) If  $(ds)^2 = 3(dx^1)^2 + 5(dx^2)^2 - 4(dx^1)(dx^2)$ , Find the matrices

(i)  $g_{qr}$

(ii)  $g^{qr}$

(iii)  $g_{qr}g^{qr}$

1+2+2=5

যদি  $(ds)^2 = 3(dx^1)^2 + 5(dx^2)^2 - 4(dx^1)(dx^2)$

হয়, তেনেহলে

i)  $g_{qr}$

(ii)  $g^{qr}$

(iii)  $g_{qr}g^{qr}$  মৌলকক্ষ কেইটা উলিওৱা।



4. Answer **any three** of the following questions :  $10 \times 3 = 30$

তলত দিয়া প্রশ্নবোৰৰ যিকোনো তিনিটাৰ উত্তৰ দিয়া :

- (a) (i) Find the eigenvalues and eigenvectors of the matrix  $3+4=7$

$$A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 3 & -1 \\ 0 & -1 & 3 \end{bmatrix}$$

$$A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 3 & -1 \\ 0 & -1 & 3 \end{bmatrix} \text{ মৌলকক্ষটোৰ}$$

আইগেনমান আৰু আইগেনভেক্টৰ উলিওৱা।

- (ii) Show that every square matrix can be expressed as sum of a symmetric and a skew symmetric matrix.  $3$

দেখুওৱা যে এটা মৌলকক্ষক এটা সমমিত আৰু এটা প্রতি সমমিত মৌলকক্ষৰ যোগফল হিচাবে প্রকাশ কৰিব পাৰি।

- (b) (i) Determine the identity element and inverse for the following Binary operation :

$$(a, b) * (c, d) = (ac, bc + d) \quad 3+3=6$$

Contd.

$(a, b) * (c, d) = (ac, bc + d)$  দ্বৈত অপাৰেচনত একক মৌল আৰু প্রতিক্রম নির্ণয় কৰা।

- (ii) Find the vector associated with the given second order antisymmetric tensor  $4$

$$\begin{bmatrix} 0 & (x+y+z) & -(x+y) \\ -(x+y+z) & 0 & x \\ (x+y) & -x & 0 \end{bmatrix}$$

$$\begin{bmatrix} 0 & (x+y+z) & -(x+y) \\ -(x+y+z) & 0 & x \\ (x+y) & -x & 0 \end{bmatrix}$$

প্রতিসমমিত দ্বিতীয় ক্রমৰ টেন্চৰটোৰ সৈতে জড়িত হোৱা ভেক্টৰটো উলিওৱা।

- (c) Using tensors, prove the following identities :

$$(i) \operatorname{div}(\operatorname{curl} \vec{A}) = 0$$

$$(ii) \vec{\nabla} \times (\phi \vec{A}) = \phi (\vec{\nabla} \times \vec{A}) + \vec{\nabla} \phi \times \vec{A}$$

$$(iii) \vec{\nabla} \times (\vec{\nabla} \times \vec{A}) = \vec{\nabla}(\vec{\nabla} \cdot \vec{A}) - \nabla^2 \vec{A}$$

$2+4+4=10$

টেনচৰ ব্যৱহাৰ কৰি প্ৰমাণ কৰা :

(i)  $\text{div}(\text{curl } \vec{A}) = 0$

(ii)  $\vec{\nabla} \times (\phi \vec{A}) = \phi (\vec{\nabla} \times \vec{A}) + \vec{\nabla} \phi \times \vec{A}$

(iii)  $\vec{\nabla} \times (\vec{\nabla} \times \vec{A}) = \vec{\nabla}(\vec{\nabla} \cdot \vec{A}) - \nabla^2 \vec{A}$

(d) (i) Derive Moment of Inertia tensor and find its components. 5+3=8

জড় ভ্ৰামক টেন্চৰ প্ৰতিস্থাপকৰা আৰু ইয়াৰ উপাংশ উলিওৱা।

(ii) Write Hooke's law of elasticity in tensorial rotation. 2

টেন্চৰৰ ভাষাত স্থিতিস্থাপকতাৰ হুকৰ সূত্ৰটো লিখা।

(e) (i) Show that every vector belonging to a vector space has a unique representation as a linear combination of its basis vector. 5

দেখুওৱা যে ভেক্টৰ স্থানৰ প্ৰতিটো ভেক্টৰেই ইয়াৰ বেছিভ ভেক্টৰৰ একক বৈখিক সংযোজন।

(ii) Find the bases and the dimension of the subspaces  $S$  of  $R^3$  defined by  $S = \{[a, b, 0] / a, b \in R\}$  5

$S = \{[a, b, 0] / a, b \in R\}$  ৰ দ্বাৰা বুজোৱা  $R^3$  ৰ উপস্থান  $S$ -ৰ বেছিভ আৰু মাত্ৰা উলিওৱা।

(f) (i) Verify Cayley-Hamilton theorem for

the matrix  $A = \begin{bmatrix} 3 & -4 \\ 1 & 5 \end{bmatrix}$ .

Also find  $A^{-1}$ . 4+2=6

$A = \begin{bmatrix} 3 & -4 \\ 1 & 5 \end{bmatrix}$  মৌল কক্ষটোৰ কাৰণে কেলি-হেমিলটন উপপাদ্যটো প্ৰমাণ কৰা আৰু  $A^{-1}$  উলিওৱা।

(ii) State and prove the Quotient law of tensor. 1+3=4

টেন্চৰৰ কোৱাশ্বেন্ট সূত্ৰটো লিখা আৰু প্ৰমাণ কৰা।

**OPTION-D**

Paper : PHY-RE-5046

**(Physics of Devices and Instruments)**

Full Marks : 60

Time : Three hours

**The figures in the margin indicate full marks for the questions.**

1. Answer **all seven** questions : (each question carries 1 mark)  $1 \times 7 = 7$

(a) Write one application of PLL.

(b) JFET is a \_\_\_\_\_ controlled device.

(c) Photoresists can be of

(i) Negative type

(ii) Positive type

(iii) Both (i) and (ii)

(iv) Neither (i) or (ii)

*(Choose the correct option)*

(d) What do you mean by serial communication?

(e) Which feedback does a multivibrator have?

(i) Positive and negative

(ii) Only negative

(iii) Regenerative

(iv) Degenerative

*(Choose the correct option)*

(f) Rectification can be done by using

(i) Transformers

(ii) Conductors

(iii) Bridge rectifiers

(iv) None of the above

*(Choose the correct option)*

(g) What do you mean by cut-off frequency in a filter?

2. Answer the following questions :  $2 \times 4 = 8$

(a) Write the difference between serial and parallel mode of communication.

(b) Draw the block diagram of a regulated power supply.

(c) What is the use of capacitor and inductor in a filter circuit?

(d) Draw the schematic diagram of locked phase and unlocked phase with necessary phase error.

3. Answer the following questions : **(any three)**

5×3=15

(a) Write about the Handshaking and interface management in data transmission.

(b) With a neat sketch, describe the construction of an *n*-channel JFET. Explain its principle of operation.

3+2=5

(c) Why do we use SSB transmission? The maximum peak-to-peak voltage of an AM wave is 16mV and the minimum peak-to-peak voltage is 4mV. Calculate the modulation index.

2+3=5

(d) What is metallization in IC fabrication process? Why is it done? Mention *any three* specific properties of the materials that should be chosen for metallization process.

1+1+3=5

(e) Write short note on IC565 or IC4046.

4. Answer the following questions : **(any three)**

10×3=30

(a) What is the basic principle of PLL? Why XOR gate is used as phase detector? What are the functions of voltage controlled oscillator and low pass filter in PLL?

2+2+3+3=10

(b) What is the difference between E-MOSFET and D-MOSFET? Show the drain current versus gate-source voltage characteristics of *n*-channel E-MOSFET and explain the terms cut-off region, ohmic or linear region. Which layer isolates terminal gate from semiconductor? How is channel formed in a MOSFET?

2+5+1+2=10

(c) Explain in brief optical lithography. What is photoresist? Give *three* differences between positive and negative photoresist? How is electron lithography different from optical lithography?

3+1+3+3=10

(d) (i) In case of amplitude modulation, show that for 100% modulation only  $\frac{1}{3}$ rd of the total power of modulated wave contains in the two side bands.

5

- (ii) With proper circuit diagram explain the working of a common emitter amplitude modulator. 5
- (e) (i) How does the process of digital modulation differ from that of analog modulation? What do you mean by amplitude shift key, frequency shift key and phase shift key? 2+3=5
- (ii) Use suitable block diagram to explain the process of radio communication. 5
- (f) What is doping? Why is it done? How are *p*-type and *n*-type semiconductors prepared? Explain in brief the following two processes of doping in the manufacturing process of IC -
- (i) Atomic diffusion
- (ii) Ion implantation 1+1+2+3+3=10

### OPTION-E

Paper : PHY-RE-5056

**(Nuclear and Particle Physics)**

Full Marks : 80

Time : Three hours

**The figures in the margin indicate full marks for the questions.**

Answer **either** in English **or** in Assamese.

1. Answer the following questions very briefly :

1×10=10

তলত দিয়া প্ৰশ্নসমূহৰ অতি চমুকৈ উত্তৰ দিয়া :

- (a) What do we mean by a stable nucleus?  
স্থিৰ নিউক্লিয়াছ বুলিলে আমি কি বুজো?
- (b) What is the relation between mass number and nuclear radius?  
ভৰ সংখ্যা আৰু নিউক্লিয় ব্যাসাৰ্ধৰ মাজত সম্পৰ্ক কি?
- (c) Define half-life of a radioactive material.  
তেজস্ক্ৰিয় পদাৰ্থ এটাৰ অৰ্ধায়ু কালৰ সংজ্ঞা দিয়া।

(d) Why neutron is not an elementary particle ?

নিউট্রন কিয় এটা মৌলিক কণিকা নহয়?

(e) What is the role of magnetic field in cyclotron ?

চাইক্লোট্রনত চুম্বক ক্ষেত্রৰ ভূমিকা কি?

(f) Write one difference between photo-electric effect and Compton scattering.

প্রকাশবিদ্যুত প্রভাৱ আৰু কম্পটন প্ৰকীৰ্ণনৰ মাজৰ এটা পাৰ্থক্য লিখা।

(g) Write one application of Geiger-Muller counter.

গাইগাৰ-মুলাৰ গাণনিকৰ এটা প্ৰয়োগ লিখা।

(h) What is the principle of neutron detector ?

নিউট্রন ডিটেক্টৰৰ কাৰ্যনীতি কি?

(i) What is the spin of gluon ?

গ্লুৱনৰ স্পিন কিমান ?

(j) What is the energy range of  $\gamma$ -ray ?

গামা ৰশ্মিৰ শক্তিৰ পৰিসৰ কি?

2. Answer the following questions :  $2 \times 5 = 10$

তলত দিয়া প্ৰশ্নসমূহৰ উত্তৰ দিয়া :

(a) Describe various characteristics of nucleus.

নিউক্লিয়াছৰ বিভিন্ন বৈশিষ্ট্যসমূহ বৰ্ণনা কৰা।

(b) What are the limitations in Bethe-Bloch formula ?

বেথে-ব্লক সূত্রৰ সীমাবদ্ধতাবোৰ কি কি?

(c) What is the difference between accelerators and reactors ?

ত্বৰক আৰু ৰিয়েক্টৰৰ মাজত পাৰ্থক্য কি?

(d) The half-life of radium is 1600 years. Find its decay constant  $\lambda$ .

ৰেডিয়াম এটাৰ অৰ্ধায়ু-কাল 1600 বছৰ। ইয়াৰ ক্ষয় ধ্ৰুৱক  $\lambda$ -ৰ মান উলিওৱা।

(e) Write the advantages of proton synchrotron.

প্ৰটন চিনক্ৰোট্ৰনৰ সুবিধাবোৰ কি কি?

3. Answer **any four** of the following questions :

5×4=20

তলত দিয়া প্ৰশ্নসমূহৰ যিকোনো চাৰিটাৰ উত্তৰ লিখা :

(a) What are nuclear forces? Discuss various properties of nuclear forces.

নিউক্লীয় বল কি? নিউক্লীয় বলৰ বিভিন্ন ধৰ্মসমূহ আলোচনা কৰা।

(b) What are the limitations of shell model?

খোল আৰ্হিৰ সীমাবদ্ধতাবোৰ কি কি?

(c) Describe a short note on neutrino hypothesis.

নিউট্ৰিন' পৰিকল্পনাৰ এটা চমু টোকা লিখা।

(d) Explain Fermi gas model of nucleus.

নিউক্লিয়াছৰ ফাৰমি গেছ আৰ্হি ব্যাখ্যা কৰা।

(e) Define Q-value of a nuclear reaction. When is a nuclear reaction exoergic or endoergic? What happens when  $Q=0$ ?

নিউক্লীয় বিক্ৰিয়াৰ Q-মানৰ সংজ্ঞা লিখা। নিউক্লীয় বিক্ৰিয়া কেতিয়া শক্তি উদ্ধাৰক আৰু শক্তিশোষক হয়?

Q-ৰ মান শূন্য হ'লে কি ঘটে?

(f) Write short notes on

(i) nuclear fission and

(ii) pair production

(i) নিউক্লীয় ভংগিক বিক্ৰিয়া আৰু

(ii) যুগ্ম উৎপাদনৰ ওপৰত চমু টোকা লিখা।

4. Answer **any four** of the following questions :

10×4=40

তলত দিয়া প্ৰশ্নসমূহৰ যিকোনো চাৰিটাৰ উত্তৰ দিয়া :

(a) Draw a neat diagram and describe the principle, construction and working of a linear accelerator.

ৰৈখিক ত্বৰক যন্ত্ৰ এটাৰ পৰিষ্কাৰ চিত্ৰ আঁকি নীতি, গঠন আৰু কাৰ্যনীতি বৰ্ণনা কৰা।

(b) Explain with neat diagram, describe the principle, construction and working of ionization chamber.

আয়নীয় চেম্বাৰৰ নীতি, গঠন আৰু কাৰ্যপ্ৰণালী সচিত্ৰ ব্যাখ্যা কৰা।

(c) Discuss in detail the Gamow's theory of  $\alpha$ -decay.

আলফা ক্ষয়ৰ গেমঅ'ৰ তত্ত্বটো বহলভাৱে আলোচনা কৰা।

(d) Show that in Compton effect the change in wavelength  $\Delta\lambda$  depends on the scattering angle  $\theta$  only.

দেখুওৱা যে কম্পটন প্ৰভাৱত তৰংগদৈৰ্ঘ্যৰ পৰিবৰ্তন  $\Delta\lambda$  কেৱল প্ৰকীৰ্ণন কোণ  $\theta$ -ৰ ওপৰত নিৰ্ভৰ কৰে।

(e) Define

(i) half-life

(ii) disintegration constant and

(iii) mean-life of a radioactive substance.

Obtain the relation between them. What do you understand by a millicurie?

$$2+2+2+3+1=10$$

তেজস্ক্ৰিয় পদাৰ্থৰ বাবে

(i) অৰ্ধায়ু-কাল

(ii) বিঘটন ধ্ৰুৱক আৰু

(iii) গড়-জীৱনকালৰ সংজ্ঞা লিখা আৰু সিহঁতৰ মাজৰ সম্পৰ্কটো উলিওৱা। মিলিকিউৰি বুলিলে কি বুজা?

(f) What is binding energy of a nucleus? Wherefrom does this energy come? Draw the graph between BE/nucleon and mass number (A) and show how stability of nucleus can be explained.

$$1+2+3+4=10$$

নিউক্লিয়াছ এটাৰ বন্ধন শক্তি কি? এই শক্তি ক'ৰ পৰা আহে? BE/nucleon আৰু ভৰ সংখ্যা (A) ৰ মাজত লেখ আঁকা আৰু নিউক্লিয়াছৰ স্থায়িত্ব কেনেদৰে ব্যাখ্যা কৰিব পাৰি দেখুওৱা।

(g) What are elementary particles? Classify them on the basis of their spin and mass. 2+8=10

মৌলিক কণিকাবোৰ কি? সিহঁতৰ স্পিন আৰু ভৰৰ ওপৰত নিৰ্ভৰ কৰি শ্ৰেণীবিভাজন কৰা।

(h) What are quarks? Describe the quark model of hadrons. 1+9=10

কোৱাৰ্ক কি? হেডৰনবোৰৰ কোৱাৰ্ক আৰ্হি বৰ্ণনা কৰা।