Total number of printed pages–28

3 (Sem–5/CBCS) PHY RE 1/2/3/4/5

2024

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 : $1\times7=7$

   (a) How are random errors minimised?

   (b) What is thermal noise?

   (c) What do you mean by piezoelectric effect?

   (d) Mention *any one* characteristic of vacuum.

   (e) What is LM 35?

   (f) Write *one* difference between an analog instrument and a digital instrument.

   (g) What do you mean by energy coupling?

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

(a) Differentiate between Accuracy and Resolution of measurement.

(b) Write the working principle of a temperature sensor.

(c) What are periodic and aperiodic signals? Explain.

(d) If the radius of a circle is measured with an error of 2%, then find the error in the measurement of its area.

3. Answer ***any three*** questions from the following : $5 \times 3 = 15$

(a) Draw the block diagram of an RLC bridge and explain its working principle.

(b) Explain what are meant by transfer function and frequency response. Differentiate between frequency response of first and second order systems.

(c) In successive experimental measurements, the time-periods of a simple pendulum are found to be 2.04*s*, 1.95*s*, 2.03*s*, 2.06*s*, 1.98*s* and 1.94*s*.

Calculate :

(i) Mean time-period

(ii) Mean absolute error

(iii) Relative error

(iv) Percentage error 1+2+1+1=5

(d) Explain the key characteristics of a transducer.

(e) What are LM35 and LM75? Explain their functions.

4. Answer ***any three*** questions from the following : 10×3=30

(a) (i) What is the working principle of a pressure gauge?

(ii) Explain the working of an ionization gauge.

(iii) Mention the different types of ionization gauge. 2+6+2=10

(b) (i) Explain, what you mean by static and dynamic characteristics of a measurement system.

(ii) Differentiate between electrical, thermal and mechanical systems. Give an example of each of these systems. 4+6=10

(c) (i) Differentiate between grounding and shielding.

(ii) What is electrostatic shielding? Explain how it works.

(iii) What is Earthing? 2+6+2=10

(d) (i) Explain the principles of measurement of current *I* and voltage *V* with a digital multimeter.

(ii) Defive the following terms:

1. Mean Deviation

2. Average Deviation

3. Standard Deviation 4+6=10

(e) (i) What is a temperature transducer? Explain its working principle.

(ii) How does a thermocouple work? Explain its working. 5+5=10

(f) Write short notes on : ***(any two)*** 5×2=10

(i) Mechanical pumps

(ii) Digital LCR bridge

(iii) Noise in measurement system

OPTION-B

Paper : PHY-RE-5026

(Embedded System : Introduction to Microcontroller)

Full Marks : 60

Time : Three hours

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

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

   (a) To built a large scale embedded system, which processors are used?

   (b) In a 16-bit processor, how many bit can form a 'word'?

   (c) How many locations can be addressed by an eight bit address bus?

   (d) Why does the 8085 microprocessors is 8-bit?

   (e) Give the name of the bidirectional bus in 8085 microprocessor.

   (f) How many general purpose registers are there in the 8084 microprocessor?

   (g) How much program memory does the 8051 microcontroller have?

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

(i) Give the name of the special purpose register of 8085 microprocessors.

(ii) Mention *two* differences between timer and counter in microcontrollers.

(iii) What are the *two* key features of 8051 microcontroller ?

(iv) Define Arduino with an example.

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

(a) How does an embedded system is different from a general purpose computing system?

(b) Discuss about the interrupt priority register in 8051.

(c) Mention the limitations of the 8051 microcontroller.

(d) Give the different groups of instruction in 8051 and their descriptions.

(e) How does a 8051 microcontroller generate a sine wave using DAC interface?

4. Answer the following : 10×3=30

(a) Discuss about the architecture of an 8-bit microprocessor and draw its block diagram.

Or

Discuss the application and use of 8051 microcontrollers. What type of RAM does a 8051 use?

(b) Draw the block diagram of 8051 microcontroller and discuss its different components.

Or

Draw the pin diagram of Arduino UNO and mention the specific functions of the pin.

(c) What are the timer mode and counter mode in 8051? Discuss in detail.

Or

What is an embedded system design? Discuss the different steps in the embedded system design process and software development process activities.

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.

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

তলত দিয়া প্ৰশ্নসমূহৰ উত্তৰ দিয়া ঃ

(a) Give the definition of a homomorphic group.

সমৰূপতা সংঘৰ সংজ্ঞা দিয়া।

(b) Define a subspace. Give *two* examples.

উপস্থানৰ এটা সংজ্ঞা দিয়া। *দুটা* উদাহৰণ লিখা।

(c) State the Cayley-Hamilton theorem.

কেলি-হেমিলটন উপপাদ্যটো লিখা।

(d) Write the Hooke's law of elasticity in tensorial notation.

স্থিতিস্থাপকতাৰ হুকৰ সূত্ৰটো টেন্‌চৰৰ ভাষাত লিখা।

(e) Write the order of the tensor

$C = a_{pr}a_{rst}$

$C = a_{pr}a_{rst}$ টেন্‌চৰটোৰ ক্ৰম লিখা।

(f) State the Quotient law of tensor.

টেন্‌চৰৰ কোৱাশ্বেন্ট্‌ সূত্ৰটো লিখা।

(g) What is mixed tensor? Give *one* example.

মিশ্ৰিত টেনচ্‌ৰ কি? *এটা* উদাহৰণ দিয়া।

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

তলৰ প্ৰশ্নসমূহৰ উত্তৰ দিয়া ঃ

(a) For a vector space $V(F)$, show that $\theta = 0.\upsilon$, for all $\upsilon \in V$.

ভেক্টৰ স্থান $V(F)$ ৰ ক্ষেত্ৰত দেখুওৱা যে $\theta = 0.\upsilon$, $\upsilon \in V$ ।

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

দেখুওৱা যে, এখন স্কেলাৰ ক্ষেত্ৰৰ নতি ৰেংক্‌ 1-ৰ কোভেৰিয়েন্ট টেনচৰ হয়।

(c) Find e^A, where $A = \begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}$.

$A = \begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}$ হলে, e^A-ৰ মান উলিওৱা।

(d) Show that $\text{div}\left(curl\ \vec{A}\right) = 0$, using tensor.

টেন্‌চৰ ব্যৱহাৰ কৰি দেখুওৱা যে $\text{div}\left(curl\ \vec{A}\right) = 0$ ।

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

তলত দিয়া প্ৰশ্নবোৰৰ ***যিকোনো তিনিটাৰ*** উত্তৰ দিয়া ঃ

(a) Define binary operation on a set. When binary operation is said to be commutative? A binary operation $*$ on set N defined by $a * b = a^b + b^a$, find $4 * 3$ and $3 * 4$. 2+1+2=5

দ্বৈত প্ৰক্ৰিয়াৰ সংজ্ঞা দিয়া। এটা দ্বৈত প্ৰক্ৰিয়া কেতিয়া ক্ৰম বিনিময় হয়? N সংহতিৰ সাপেক্ষে $*$ এটা দ্বৈত প্ৰক্ৰিয়া যাৰ সংজ্ঞা $a * b = a^b + b^a$, তেন্তে $4 * 3$ আৰু $3 * 4$ ৰ মান নিৰ্ণয় কৰা।

(b) Are the following vectors linearly dependent? If so, find a relation between them

$$x_1 = (3,2,7),\ x_2 = (2,4,1),\ x_3 = (1,-2,6)$$

3+2=5

তলত দিয়া ভেক্টৰ কেইটা বৈখিকভাৱে স্বতন্ত্ৰ নে? যদি হয়, সিঁহতৰ মাজৰ সম্বন্ধটো উলিওৱা।

$x_1 = (3,2,7),\ x_2 = (2,4,1),\ x_3 = (1,-2,6)$

(c) Show that the modulus of each eigen-value of a unitary matrix is unity. 5

দেখুওৱা যে ইউনিটেৰি মৌলকক্ষ এটাৰ প্ৰত্যেকটো আইগেন মানৰ মাপাংক 1.

(d) Calculate the matric tensor in 3D Euclidean space for the co-ordinates

$u = x + 2y,\ v = x - y,\ w = z$. 5

$u = x + 2y,\ v = x - y,\ w = z$ স্থানাংকৰ কাৰণে 3D ইউক্লিদিয়ান স্থানত মেট্ৰিক টেন্‌চৰ নিৰ্ণয় কৰা।

(e) Find the second order anti-symmetric tensor associated with the vector $7\hat{i} + 3\hat{j} + 4\hat{k}$. 5

$7\hat{i} + 3\hat{j} + 4\hat{k}$ ভেক্টৰটোৰ সৈতে জড়িত হৈ থকা দ্বিতীয় ক্ৰমৰ প্ৰতিসমমিত টেন্‌চৰটো উলিওৱা।

4. (a) (i) Define a group. When a group is said to be Abelian? Prove that the set I of all the integers with the binary operation $*$ defined by $a * b = a + b + 1$, forms a group. 1+1+4=6

সংঘৰ সংজ্ঞা দিয়া। সংঘ এটাক কেতিয়া এবেলীয় কোৱা হয়? প্ৰমাণ কৰা যে $a * b = a + b + 1$ ৰ দ্বাৰা বুজোৱা দ্বৈত প্ৰক্ৰিয়া $*$ ৰ সৈতে সকলো অখণ্ড সংখ্যাৰ সংহতি I য়ে এটা সংঘ গঠন কৰে।

(ii) Determine the identity element and inverse for the binary operation $(a,b)*(c,d)=(ac,bc+d)$.

2+2=4

দ্বৈত প্ৰক্ৰিয়া $(a,b)*(c,d)=(ac,bc+d)$ ৰ কাৰণে একক মৌল আৰু প্ৰতিক্ৰম উলিওৱা।

Or/ অথবা

(b) (i) Show that any tensor A_{pq} can be expressed as a sum of a symmetric and a anti-symmetric tensor. 4

দেখুওৱা যে যিকেনো টেন্‌চৰ A_{pq} হ'ল সমমিত আৰু প্ৰতিসমমিত দুটা অংশৰ যোগফল।

(ii) Find the eigenvalues and eigen-victors of the matrix $A = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

3+3=6

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$ মৌলকক্ষটোৰ আইগেন মান

আৰু আইগেন ভেক্টৰ উলিওৱা।

5. (a) (i) Using matrix method, solve the coupled differential equation,

$$y_1' = 3y_1 + y_2$$

$$y_2' = y_1 + 3y_2$$

subject to initial conditions $y_1(0) = 3;\ y_2(0) = 5.$ 7

$$y_1' = 3y_1 + y_2$$

$$y_2' = y_1 + 3y_2$$

যৌথ অৱকলজ সমীকৰণ কেইটা সমাধান কৰা, য'ত প্ৰাৰম্ভিক চৰ্ত্ত হ'ল

$y_1(0) = 3;\ y_2(0) = 5$ ।

(ii) If $A^p B_{qr}$ is a tensor for all contravariant tensors A^p, then show that B_{qr} is also a tensor. 3

যদি সকলো কন্ট্ৰাভেৰিয়েন্ট টেন্চৰ A^p ৰ কাৰণে $A^p B_{qr}$ টেন্চৰ হয়, তেন্তে দেখুওৱা যে B_{qr} ও এটা টেন্চৰ।

Or/ অথবা

(b) (i) Find whether the set of vectors $[\alpha, \beta, \gamma]$ in R^3 such that $\alpha + \beta + \gamma = 0$ forms a subspace of R^3. 5

R^3 ও $[\alpha, \beta, \gamma]$ ভেক্টৰ সংহতি যাতে $\alpha + \beta + \gamma = 0$ য়ে R^3 ত উপস্থান গঠন কৰেনে নিৰ্ণয় কৰা।

(ii) Verify the Cayley-Hamilton theorem for the matrix $A = \begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$ and hence find A^{-1}. 5

$A = \begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$ মৌলকক্ষটোৰ কাৰণে কেলি-হেমিল্টন উপপাদ্যটো প্ৰমাণ কৰা আৰু A^{-1}ৰ মান নিৰ্ণয় কৰা।

6. *(a)* Using tensor, prove the following vector identities : 3+3+4=10

(i) $\left(\vec{A}\times\vec{B}\right)\times\vec{C}=\vec{B}\left(\vec{A}.\vec{C}\right)-\vec{A}\left(\vec{B}.\vec{C}\right)$

(ii) $\vec{\nabla}.\left(\vec{A}\times\vec{B}\right)=\left(\vec{\nabla}\times\vec{A}\right).\vec{B}-\left(\vec{\nabla}.\vec{B}\right).\vec{A}$

(iii) $\vec{\nabla}\times\left(\vec{\nabla}\times\vec{A}\right)=\vec{\nabla}\left(\vec{\nabla}.\vec{A}\right)-\nabla^2 A$

টেন্‌চৰ ব্যৱহাৰ কৰি তলৰ ভেক্টৰ সম্বন্ধ কেইটা প্ৰমাণ কৰা ঃ

(i) $\left(\vec{A}\times\vec{B}\right)\times\vec{C}=\vec{B}\left(\vec{A}.\vec{C}\right)-\vec{A}\left(\vec{B}.\vec{C}\right)$

(ii) $\vec{\nabla}.\left(\vec{A}\times\vec{B}\right)=\left(\vec{\nabla}\times\vec{A}\right).\vec{B}-\left(\vec{\nabla}.\vec{B}\right).\vec{A}$

(iii) $\vec{\nabla}\times\left(\vec{\nabla}\times\vec{A}\right)=\vec{\nabla}\left(\vec{\nabla}.\vec{A}\right)-\nabla^2 A$

Or/অথবা

(b) If $(ds)^2=3\left(dx^1\right)^2+5\left(dx^2\right)^2-4\left(dx^1\right)\left(dx^2\right)$, then find the matrices —

2+2+2=6

(a) g_{qr}

(b) g^{qr}

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

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

(a) g_{qr}

(b) g^{qr}

(c) $g_{qr}g^{qr}$.

মৌলকক্ষ কেইটাৰ মান নিৰ্ণয় কৰা।

(c) What is moment of Inertia tensor? Show that it is a symmetric tensor of order 2. 2+2=4

জড় ভ্ৰামক টেন্‌চৰ কি? দেখুওৱা যে জড় ভ্ৰামক টেন্‌চৰ 2 ক্ৰমৰ এটা সমমিত টেন্‌চৰ।

OPTION–D

Paper : PHY–RE–5046

(Physics of Device and Instrumentation)

Full Marks : 60

Time : Three hours

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

1. Fill in the blanks : 1×7=7

   (i) Junction Field Effect Transistor (JFET) is a ________ controlled device.

   (ii) Rectifier of a DC power supply converts an AC input from mains to a ________ output.

   (iii) ________ filter is a passive electronic device has lowest cut of frequency.

   (iv) SiO_2 layer in an Integrated Circuit (IC) acts a ________.

   (v) Multivibrator circuit has ________ feedback.

   (vi) The modulation index of an Amplitude Modulated waveform is ranges between ________ to ________.

(vii) The process of separating message signal from the carrier signal is known as ________.

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

(a) What are the common defects exists in a lattice structure?

(b) What are the differences between serial and parallel data communication?

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

(d) Give a comparison between a JFET and MOSFET device.

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

(a) How GPIB is implemented on a PC? Give the basic idea about sending data through COM port.

(b) Discuss briefly about working principle of a phase lock loop (PLL)

(c) What is amplitude modulated wave? Draw the block diagram for generation of an AM waveform.

(d) What is a depletion type MOSFET? Discuss the operation of a depletion type MOSFET with its input-output characteristic curve.

(e) Discuss briefly the operation of a 1st order band-pass filter with its circuit diagram.

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

(a) How phase detector can be implemented in a PLL block? What is the role of the voltage-controlled oscillator during the operation of a PLL, discuss briefly.

(b) What is the role of oxide layer in the IC fabrication process? Discuss briefly about the different steps involved for fabrication of an Integrated Circuit (IC).

(c) Draw the block diagram of a complete wireless communication setup. What is the need of modulation for wireless communication? Discus the operation of a Common Emitter based Amplitude Modulation Technique.

(d) Derive the expression of a drain current in an enhancement type MOSFET.

(e) Explain RS232 communication standards. Discuss briefly about universal serial BUS and its applications.

(f) Write short notes on *any two* of the following :

(i) Monostable Multivibrator

(ii) Line and Load Regulation for a regulated power supply

(iii) Optical Lithography

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.

1. Answer the following question very briefly: 1×10=10

তলত দিয়া প্ৰশ্নসমূহৰ অতি চমুকৈ উত্তৰ দিয়া ঃ

(a) Why, in place of Joule, electron volt (eV) is used as the unit of energy in atomic or nuclear phenomena?

পাৰমাণৱিক বা নিউক্লীয় পৰিঘটনাত জুলৰ সলনি ইলেকট্ৰন ভল্ট কিয় শক্তিৰ একৰ হিচাপে ব্যৱহাৰ কৰা হয়?

(b) Why the ionizing power of α-particle is very high?

আলফা কণাৰ আয়নীয় ক্ষমতা কিয় বহুত বেছি?

(c) Name one instrument which is used to detect radioactive rays.

তেজস্ক্ৰিয় ৰশ্মি চিনাক্ত কৰা এটা যন্ত্ৰৰ নাম লিখা।

(d) What is nuclear stability?

নিউক্লীয় স্থিৰতা কি?

(e) Mention the main drawback of liquid drop model.

তৰল টোপাল আৰ্হিৰ প্ৰধান প্ৰতিবন্ধকতা উল্লেখ কৰা।

(f) Write the mediator particle in strong interaction.

শক্তিশালী ক্ৰিয়াৰ মধ্যস্থতাকাৰী কণাৰ নাম লিখা।

(g) Name the instrument which can be accelerated an electron.

ইলেকট্ৰন কণা ত্বৰিত কৰিব পৰা যন্ত্ৰটোৰ নাম লিখা।

(h) What is the nuclear radius of ^{125}Fe, if that of ^{27}Al is 3.6 fermi?

^{125}Fe-ৰ নিউক্লীয় ব্যাসাৰ্ধ কিমান হ'ব, যদি ^{27}Al-ৰ 3.6 fermi হয়?

(i) What process creates the energy of the sun?

কি প্ৰক্ৰিয়াই সূৰ্য্যৰ শক্তি সৃষ্টি কৰে?

(j) What are the spin of quarks?

কোৱাৰ্কৰ স্পিন কিমান?

2. Answer the following questions : 2×5=10

তলত দিয়া প্ৰশ্নসমূহৰ উত্তৰ দিয়া ঃ

(a) Discuss the effect of magic number on nuclear stability.

নিউক্লীয় সুস্থিৰতাৰ ওপৰত জাদুকৰী সংখ্যাৰ প্ৰভাৱ আলোচনা কৰা।

(b) Write *two* differences between alpha and beta particles.

আলফা আৰু বিটা কণিকাৰ *দুটা* পাৰ্থক্য উল্লেখ কৰা।

(c) Explain, what is β-decay.

বিটা ক্ষয় কি ব্যাখ্যা কৰা।

(d) Describe how electron capture occurs.

ইলেকট্ৰন পৰিগ্ৰহণ কেনেদৰে হয়, বৰ্ণনা কৰা।

(e) What are the baryon number and lepton number of a proton?

প্ৰটনৰ বেৰিয়ন সংখ্যা আৰু লেপটন সংখ্যা কি?

3. Answer ***any four*** of the following questions: 5×4=20

তলত দিয়া প্ৰশ্নসমূহৰ ***যিকোনো চাৰিটাৰ*** উত্তৰ লিখা ঃ

(a) Discuss the most important conservation laws in nuclear reactions.

নিউক্লীয় বিক্রিয়াৰ অতি দৰকাৰী সংৰক্ষণ সূত্ৰসমূহ আলোচনা কৰা।

(b) Show that nuclear density is constant.
দেখুওৱা যে নিউক্লীয় ঘনত্ব ধ্ৰুৱক।

(c) Discuss the neutrino hypothesis in beta decay.
বিটা ক্ষয়ৰ ক্ষেত্ৰত নিউট্ৰিনো প্ৰকল্প আলোচনা কৰা।

(d) Explain the working principle of neutron detector.
নিউট্ৰন সংসূচকৰ কাৰ্য্যপ্ৰণালী ব্যাখ্যা কৰা।

(e) Derive an expression for Geiger-Nuttal law of radioactivity.
তেজস্ক্ৰিয়তাৰ গাইগাৰ-নাটাল সূত্ৰটো উলিওৱা।

(f) What are quarks? Write their characteristies.
কোৱাৰ্ক কি? সিহঁতৰ বৈশিষ্ট্যসমূহ লিখা।

4. Answer ***any four*** of the following questions: 10×4=40

তলত দিয়া প্ৰশ্নসমূহৰ ***যিকোনো চাৰিটাৰ*** উত্তৰ লিখা ঃ

(a) Describe in brief the liquid drop model. Derive the semi-empirical mass formula. 3+7=10

তৰল টোপাল আৰ্হি চমুকৈ বৰ্ণনা কৰা। অৰ্ধ-অভিজ্ঞতাভিত্তিক ভৰৰ সূত্ৰটো উলিওৱা।

(b) Describe the working principle of proton synchrotron. Discuss the difference between proton synchrotron and cyclotron. 6+4=10

প্ৰট'ন চিনক্ৰট্ৰ'নৰ কাৰ্য্যপ্ৰণালী বৰ্ণনা কৰা। প্ৰট'ন চিনক্ৰট্ৰ'ন আৰু ছাইক্লট্ৰ'নৰ মাজৰ পাৰ্থক্য আলোচনা কৰা।

(c) Describe in detail Rutherford's alpha particle scattering experiment.

ৰাদাৰফৰ্ডৰ আলফা কণা প্ৰকীৰ্ণন প্ৰয়োগ বহলভাৱে বৰ্ণনা কৰা।

(d) Establish the Bethe-Block formula for energy lost by charged particle due to ionization.

আয়নীকৰণৰ বাবে হোৱা আবেশিত কণাৰ শক্তিক্ষয়ৰ বেথে-ব্লক সূত্ৰটো স্থাপন কৰা।

(e) Describe how particles can be accelerated using Van de Graaff generator. Discuss the accelerator facility in India. 5+5=10

ভান ডে গ্ৰাফ জেনেৰেটৰৰ সহায়ত কণা কিদৰে ত্বৰিত কৰিব পাৰি বৰ্ণনা কৰা। ভাৰতৰ ত্বৰক যন্ত্ৰসমূহৰ সুবিধাৰ বিষয়ে আলোচনা কৰা।

(f) What are mass defect and binding energy? Discuss in detail the binding energy curve. 4+6=10

ভৰ ঘাটি আৰু বন্ধন শক্তি কি? বন্ধন শক্তিৰ লেখ বহলভাৱে আলোচনা কৰা।

(g) What are different types of fundamental interactions? What are elementary particles? Discuss the conservation laws of elementary particles. 4+1+5=10

বিভিন্ন ধৰণৰ মৌলিক পাৰস্পৰিক ক্ৰিয়া কি কি? মৌলিক কণিকাবোৰ কি কি? মৌলিক কণিকাৰ সংৰক্ষণ সূত্ৰবোৰ আলোচনা কৰা।

(h) Name the different types of quarks and mention their electric charges. Define parity, lepton number, baryon number, isospin and strangeness for elementary particles. 5+5=10

বিভিন্ন ধৰণৰ কোৱাৰ্কৰ নাম লিখা আৰু সিহঁতৰ বৈদ্যুতিক আধান উল্লেখ কৰা। মৌলিক কণাৰ সমানতা, লেপটন সংখ্যা, বেৰিয়ন সংখ্যা, সমভাৱিক প্ৰচক্ৰণ' আৰু বিচিত্ৰতাৰ সংজ্ঞা দিয়া।