

Section-I

- ଅନିମ୍ନ ଛାଡ଼ାଗୁଡ଼ିକ ନିର୍ବାଚନ କରନ୍ତୁ: (MCQ) 1x7=7
1. ଉପରୋକ୍ତ ସମସ୍ତଙ୍କ ମଧ୍ୟରୁ କେଉଁ ଗୁଣର ପରିମାପକ?
    - a) ଦୈର୍ଘ୍ୟ, b) ସମୟ, c) ବୃତ୍ତାନ୍ତ, d) ଆବୃତ୍ତି
  2. ଛାଡ଼ା ଉପରେ ପ୍ରତିବିମ୍ବିତ କରାଯାଇଥିବା ପଦାର୍ଥର ଦୈର୍ଘ୍ୟ  $P_1$  ଓ  $P_2$  ଉପରେ ଛାଡ଼ା କରାଯାଇଥିବା ଦୈର୍ଘ୍ୟ  $P$  କିପରି ସମ୍ପର୍କିତ?
    - a)  $0^\circ$ , b)  $60^\circ$ , c)  $120^\circ$ , d)  $90^\circ$
  3.  $\omega$  ଓ ବ୍ୟାସ  $r$  ଥିବା ଏକ ଚକର କେନ୍ଦ୍ରୀୟ କୋଣ  $\theta$  ରେ ଘୂରୁଥିବା କେନ୍ଦ୍ରୀୟ ବିନ୍ଦୁର ବେଗ  $v$  କିପରି ସମ୍ପର୍କିତ?
    - a)  $\omega(1 + \frac{r}{k})$ , b)  $\omega(1 - \frac{r}{k})$ , c)  $\omega$ , d)  $2\omega$
  4. ଏକ ବସ୍ତୁ  $R$  ଉଚ୍ଚତାରୁ ଛାଡ଼ା ଦିଆଯାଇଥିବା ସମୟ  $t$  ମଧ୍ୟରେ ଉପରକୁ ଘୂରୁଥିବା ବସ୍ତୁର ଉଚ୍ଚତା  $h$  କିପରି ସମ୍ପର୍କିତ?
    - a)  $h = \frac{R}{2}$ , b)  $h = \frac{R}{\sqrt{2}}$ , c)  $h = (\sqrt{2} + 1)R$ , d)  $h = (\sqrt{2} - 1)R$
  5.  $L$  ଦୈର୍ଘ୍ୟ,  $A$  କ୍ଷେତ୍ରଫଳ ଥିବା ଏକ ସରଳ ଚୁମ୍ବକୀୟ କଣ୍ଡକର କେନ୍ଦ୍ରୀୟ ବିନ୍ଦୁରୁ  $Y$  ଦୂରରେ ଥିବା ଏକ ବିନ୍ଦୁରୁ କେନ୍ଦ୍ରୀୟ ବିନ୍ଦୁରୁ  $K$  ଚୁମ୍ବକୀୟ କ୍ଷେତ୍ର  $K$  କିପରି ସମ୍ପର୍କିତ?
    - a)  $K = \frac{\mu_0 YA}{L}$ , b)  $K = \frac{2\mu_0 YA}{L}$ , c)  $K = \frac{\mu_0 YA}{2L}$ , d)  $K = \frac{\mu_0 YL}{A}$
  6.  $a_1$  ଓ  $a_2$  ଉଚ୍ଚତାରୁ ଛାଡ଼ା ଦିଆଯାଇଥିବା ଦୁଇଟି ବସ୍ତୁର ଉଚ୍ଚତା  $h$  କିପରି ସମ୍ପର୍କିତ?
    - a)  $\frac{a_1}{a_2}$ , b)  $\frac{a_2}{a_1}$ , c)  $\frac{a_1^2}{a_2^2}$ , d)  $\frac{a_2^2}{a_1^2}$
  7.  $x = A \sin \omega t + B \cos \omega t$  - ଏହା କେଉଁ ପ୍ରକାରର ଗତି?
    - a)  $A+B$ , b)  $A-B$ , c)  $\sqrt{A^2+B^2}$ , d)  $\sqrt{A^2-B^2}$

Section-II  
 Group - 'A'

- ନିମ୍ନଲିଖିତ ପ୍ରଶ୍ନଗୁଡ଼ିକ ଛାଡ଼ା କରନ୍ତୁ: (ସିଧାସଳଖ ପ୍ରଶ୍ନ ଉପରେ ନିର୍ଦ୍ଦେଶ)
1. ଏକ ଚୁମ୍ବକୀୟ କ୍ଷେତ୍ରରେ ଏକ ଚୁମ୍ବକୀୟ କଣ୍ଡକର ଉପରେ କାର୍ଯ୍ୟ କରୁଥିବା ବଳ କିପରି ସମ୍ପର୍କିତ?
 

$\vec{F} = q(\vec{E} + \vec{v} \times \vec{B})$
  2.  $\vec{L}$  - ଏହା କଣ୍ଡକର ଦୈର୍ଘ୍ୟ, 1x2=2

নিম্নলিখিত প্রশ্নগুলির উত্তর দাও: (বিষয় প্রশ্নগুলি লম্বানীতি) 2x3=6  
 1. ধরি  $u_n$  হলি তিরসমানের  $n$ তম পদ।  $u_1 = 1$  এবং  $u_{n+1} = 2u_n + 1$ ।  $u_n$  এর সীমিত মানের  $n$  এর মান কত? 2

$M$  এর  $n$ তম পদ  $u_n$  কে  $u_n = a + (n-1)d$  আকারে লিখা যায়।  $a$  এবং  $d$  এর মান নির্ণয় কর।  
 2.  $u_n$  এর  $n$ তম পদ  $u_n = \frac{1}{n}$ ।  $u_n$  এর সীমিত মানের  $n$  এর মান কত? 2  
 3.  $u_n$  এর  $n$ তম পদ  $u_n = n^2$ ।  $u_n$  এর সীমিত মানের  $n$  এর মান কত? 2

$M$  এর  $n$ তম পদ  $u_n$  কে  $u_n = a + (n-1)d$  আকারে লিখা যায়।  $a$  এবং  $d$  এর মান নির্ণয় কর।  
 4.  $u_n$  এর  $n$ তম পদ  $u_n = n^2$ ।  $u_n$  এর সীমিত মানের  $n$  এর মান কত? 2

Group-'C'

নিম্নলিখিত প্রশ্নগুলির উত্তর দাও: (বিষয় প্রশ্নগুলি লম্বানীতি) 3x5=15  
 4.  $u_n$  এর  $n$ তম পদ  $u_n = a + (n-1)d$ ।  $u_1 = 1$  এবং  $u_5 = 13$ ।  $u_n$  এর সীমিত মানের  $n$  এর মান কত? 3

i)  $u_n$  এর  $n$ তম পদ  $u_n = a + (n-1)d$ ।  $u_1 = 1$  এবং  $u_5 = 13$ ।  $u_n$  এর সীমিত মানের  $n$  এর মান কত?  
 ii)  $u_n$  এর  $n$ তম পদ  $u_n = a + (n-1)d$ ।  $u_1 = 1$  এবং  $u_5 = 13$ ।  $u_n$  এর সীমিত মানের  $n$  এর মান কত?  
 5.  $u_n$  এর  $n$ তম পদ  $u_n = a + (n-1)d$ ।  $u_1 = 1$  এবং  $u_5 = 13$ ।  $u_n$  এর সীমিত মানের  $n$  এর মান কত? (1+2)  
 6.  $u_n$  এর  $n$ তম পদ  $u_n = a + (n-1)d$ ।  $u_1 = 1$  এবং  $u_5 = 13$ ।  $u_n$  এর সীমিত মানের  $n$  এর মান কত? (1+2)  
 7.  $u_n$  এর  $n$ তম পদ  $u_n = a + (n-1)d$ ।  $u_1 = 1$  এবং  $u_5 = 13$ ।  $u_n$  এর সীমিত মানের  $n$  এর মান কত? (1+1+1)

$u_n$  এর  $n$ তম পদ  $u_n = a + (n-1)d$ ।  $u_1 = 1$  এবং  $u_5 = 13$ ।  $u_n$  এর সীমিত মানের  $n$  এর মান কত? 3

8. ગુરુત્વકર્ષણ-સંક્રમણ દાખલામાં સૂચવેલ વિધેય યાજો.

સરળ હાર્મોનિક ગતિ કરતી કણની સ્થાને સમુદ્ર સત્તરે સ્થાપિત  $y = 3 \sin 60\pi t$ ,  
ગુરુત્વકર્ષણ, મર્યાદાવાળા ઓસ્કિલેશનના ઇલેન નિર્ભર  
યાજો. (1+1)

Group-D

નિમ્નલિખિત પ્રશ્નોના ઉકાર આપો: (વિદ્યમાન પ્રશ્નોની સંખ્યાનો આધાર)  $5 \times 1 = 5$

- 9. i) હેલિયમ અણુના ક્ષેત્રફલિત સમતલ અવકાશીય ઇલેક્ટ્રોનના પરિભ્રમણની ગતિમાત્રાનું નિર્ભર યાજો.
- ii) સૂત્રો દ્વારા સ્પષ્ટ કરો કે સ્પર્શક અને સૂત્રો દ્વારા સ્પર્શક ગતિમાત્રાના નિર્ભર યાજો. (2+1+2)

or

- i) સ્પર્શક દ્વારા સ્પર્શક યાજો? ii) 'સરળ હાર્મોનિક ગતિ અને અસ્પર્શક ગતિ, વિદ્યુત્તર અસ્પર્શક ગતિ સરળ હાર્મોનિક ગતિ, કઈ કેટલાક ભાગ્યદાયક.
- iii) સ્પર્શકમાં,  $x = A \sin \omega t$  સ્થાપિત કરી સરળ હાર્મોનિક ગતિ નિર્ભર યાજો. (1+2+2)

Section - I

Choose the correct answer: (MCQ)

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1. Steradian is the unit of  
a) angle, b) solid angle, c) arc of a circle, d) circumference
2. Magnitude of each of two vectors is P. Magnitude of the resultant of the two is also P. Angle between the vectors is  
a)  $0^\circ$ , b)  $60^\circ$ , c)  $120^\circ$ , d)  $90^\circ$
3. A man of weight  $w$  is in a lift which is moving up with an acceleration  $a$ . If acceleration due to gravity is  $g$ , apparent weight of the man will be  
a)  $w(1 + \frac{a}{g})$ , b)  $w(1 - \frac{a}{g})$ , c)  $w$ , d) zero.
4. If the earth is assumed to be a sphere of radius  $R$ , the height above the surface of the earth where the value of the acceleration due to gravity will be half its value on the earth's surface is  
a)  $h = \frac{R}{2}$ , b)  $h = \frac{R}{\sqrt{2}}$ , c)  $h = (\sqrt{2} + 1)R$ , d)  $h = (\sqrt{2} - 1)R$
5. A wire of length  $L$  and area of cross section  $A$ , having Young's modulus  $\gamma$  of its material, behaves like a spring of force constant  $k$ . The value of  $k$  will be  
a)  $k = \frac{\gamma A}{L}$ , b)  $k = \frac{2\gamma A}{L}$ , c)  $k = \frac{\gamma A}{2L}$ , d)  $k = \frac{\gamma L}{A}$
6. Two metallic spheres of radii  $a_1$  and  $a_2$  are falling freely through a viscous medium. The ratio of their terminal velocities will be  
a)  $\frac{a_1}{a_2}$ , b)  $\frac{a_2}{a_1}$ , c)  $\frac{a_1^2}{a_2^2}$ , d)  $\frac{a_2^2}{a_1^2}$
7. The amplitude of vibration of the SHM represented by the equation  $x = A \sin \omega t + B \cos \omega t$  is  
a)  $A + B$ , b)  $A - B$ , c)  $\sqrt{A^2 + B^2}$ , d)  $\sqrt{A^2 - B^2}$

Section-IIgroup - 'A'

Answer the following questions: (Alternative is to be noted)  $1 \times 2 = 2$

1. Does a particle with a uniform speed in a curved path possess any acceleration?

- or  
 2. Write down the dimension of  $G_2$ .  
 What is the angle between the vectors  $\vec{A}$  and  $\vec{A} \times \vec{B}$ ?

group - 'B'

Answer the following questions: (Alternatives are to be noted)

1. Under which condition will the magnitude of the resultant  $2 \times 3 = 6$  of two vectors be equal to that of any one of the constituent vectors?

or  
 A balloon of mass  $M$ , carrying some sand is descending with an acceleration  $a$ . When  $\frac{1}{4}M$  of the sand is emptied out of the balloon, the balloon descends with a uniform velocity. Find the initial mass of sand in the balloon. 2

2. Why do two streamlines never intersect each other? 2  
 3. What will be the effect on the value of the acceleration due to gravity on the earth's surface, if the radius of the earth suddenly reduces to half its present value and the mass remains constant? 2

or  
 What should be the displacement of a particle, executing SHM, from its position of equilibrium so that the kinetic energy and the potential energy of the particle are equal? 2

group - 'C'

Answer the following questions: (Alternatives are to be noted)

4. With the help of a graph, establish the equation  $S_n = u + \frac{1}{2}a(2n-1)$ , all symbols have their usual meanings.  $3 \times 5 = 15$

- or  
 i) write the polygon law of vector addition. 3  
 ii) Show that, polygon law can be derived from the triangle law of vectors.

(1+2)

5. What is meant by impulse of a force? Prove that, impulse of a force on a body is equal to the change in momentum of the body. (1+2)
6. Define Poisson's ratio. What are its limiting values? Write down Hooke's law. (1+1+1)
7. What is Reynolds number? Write down its dimension. Write down the mathematical form of Stokes's law. (1+1+1)

Show that surface energy <sup>or</sup> per unit area is numerically equal to surface tension. 3

8. State Kepler's laws of planetary motion. 3

Equation of a SHM is  $y = 3 \sin 60\pi t$ . Calculate its amplitude, time period and acceleration at its position of maximum displacement. (1+1+1)

group - D'

Answer the following question: (Alternative is to be noted)

q.i) Establish a relation showing the variation of the acceleration due to gravity with the increase in altitude from the surface of the earth.  $5 \times 1 = 5$

ii) What do you mean by escape velocity? Determine the expression of the escape velocity for the earth. (2+1+2)

i) What is a seconds pendulum? ii) 'Simple harmonic motion is a periodic motion, but all periodic motions are not simple harmonic' - explain. <sup>or</sup>

iii) Show that the equation  $x = A \sin \omega t$  represents a simple harmonic motion. (1+2+2)