ශ්‍රී ලංකා විවෘත විශ්ව විද්‍යාලය
විද්‍යාවේදී උපාධි පාඨමාලාව – තුන්වන මට්ටම
අවසාන පරීක්ෂණය – 2012/2013
තරංග පිළිබඳ භෞතික විද්‍යාව – PYU1162 / PYE3162

දිනය : 2013.12.10 **වේලාව :** පෙ.ව 9.30 සිට පෙ.ව. 11.30 දක්වා

ඕනෑම ප්‍රශ්න හතරකට (4) පමණක් පිළිතුරු සපයන්න.

1. (i) හුක්ගේ නියමය සහ චලිතය සඳහා වූ නිව්ටන්ගේ දෙවන නියමය ලියා දක්වන්න. (යම් සංකේතයක් යොදා ගන්නේ නම් ඒවා අර්ථ දක්වන්න.)

(ii) ඉහතින් දැක්වූ නියම යොදාගනිමින් දුණු නියතය k වූ දුන්නකට සවිකරන ලද සරල අනුවර්තී චලිතයේ යෙදෙන m ස්කන්ධයෙන් යුතු අංශුවක් සඳහා වූ චලිත සමීකරණය ව්‍යුත්පන්න කරන්න.

(iii) සරල අනුවර්තී චලිතයක විස්ථාපනය $x = A\cos(\omega t + \alpha)$ මඟින් දී ඇත්නම් කාලය t වන මොහොතක එහි ප්‍රවේගය හා ත්වරණය සොයන්න. මෙහි $\omega^2 = k/m$ වේ. A හා α නියතයන්ය.

(iv) සරල අනුවර්තී චලිතයේ යෙදෙන 10 g වූ අංශුවක, කාලය $t = 2\,s$ වන මොහොතක විස්ථාපනය 5 cm සඳහා ත්වරණය $-20\,cms^{-2}$ ක් විය.
(a) චලිතයේ කෝණික සංඛ්‍යාතය කුමක්ද?
(b) අංශුවේ උපරිම වාලක ශක්තිය කුමක්ද? (ආරම්භක කලාව ශූන්‍ය සේ සළකන්න.)

2. (i) එකිනෙකට ලම්බක හා $\pi/2$ කලා වෙනසකින් යුතු පහත සඳහන් සරල අනුවර්තී චලිත දෙකෙහි සම්ප්‍රයුක්ත චලිතය සඳහා සමීකරණය ලබා ගන්න.
$x = a\cos(\omega t)$ සහ $y = b\cos(\omega t + \pi/2)$. මෙහි a හා b යනු නියත වේ.

(ii) ලිසාජු රූපයක් ඇසුරින් එම සම්ප්‍රයුක්ත චලිතය පහදන්න.

(iii) සම්ප්‍රයුක්ත චලිතය වෘත්තාකාර වීම සඳහා ඉහත චලිත දෙකෙහි නියතයන් වෙනස් කරන්නේ කෙසේද?

3. දුණු නියතය $k = 20\,Nm^{-1}$ වන ඒකාකාර දුන්නකට සවිකරන ලද ස්කන්ධය $m = 0.2\,kg$ වූ අංශුවක් සුමට තිරස් තලයක් මත දෝලනය වේ.

(i) දෝලනයේ සංඛ්‍යාතය ව්‍යුත්පන්න කරන්න.

(ii) ඉහත පද්ධතිය මත බාහිරින් $-0.1V$ වන බලයක් (මෙහි V යනු එම මොහොතේ අංශුවේ ප්‍රවේගයයි.) යෙදේ නම් නව චලිතය සඳහා සංඛ්‍යාත්මක නියතයන් සහිතව අවකලන සමීකරණයක් ලබා ගන්න.

(iii) එම චලිතය (ii පරිදි) කලා කෝණය $\frac{\pi}{2}$ වන පරිදි ආරම්භ වූයේ නම් සහ විස්තාරය $0.12\,\mathrm{m}$ නම්, චලිතයේ විස්ථාපනය ලියා දක්වන්න.

(iv) එම චලිතයේ විස්ථාරය විචලනය වන ආකාරය කෙටියෙන් පැහැදිලි කොට එම විචලනය කාලය සමඟ දළව ප්‍රස්ථාරගත කරන්න.

4. (i) ධ්වනිය සඳහා ඩොප්ලර් ආචරණය කෙටියෙන් පහදන්න. ඒ සඳහා ප්‍රයෝගික යෙදීම් තුනක් නම් කරන්න.

(ii) නිසලව සිටින නිරීක්ෂකයෙකු තමා දෙසට V_s ප්‍රවේගයෙන් ළඟා වන f_0 සංඛ්‍යාතයෙන් යුත් ධ්වනි ප්‍රභවයක සංඛ්‍යාතය, f_0 ලෙස නිරීක්ෂණය කරයි. f_0 සඳහා ප්‍රකාශනයක් ව්‍යුත්පන්න කරන්න. (වාතයේ ධ්වනි ප්‍රවේගය V ලෙස සළකන්න.)

(iii) පදික වේදිකාවක නැවතී සිටින ඔබට, ඔබ වෙතට ළඟා වන ගිලන් රථයක නලා හඬෙහි සංඛ්‍යාතය $560\,\mathrm{Hz}$ ලෙස දැනේ යැයි සිතන්න. ඔබව පසුකර යනවිට එය $480\,\mathrm{Hz}$ ලෙස දැනේ නම්, ගිලන් රථයෙහි ප්‍රවේගය සොයන්න.

5. (i) ධ්වනිය සඳහා පහත සඳහන් ක්‍රියාවලී කෙටියෙන් පහදන්න.
(a) නිර්මාණකාරී සහ විනාශකාරී නිරෝධනය
(b) ධ්වනිචාරය (Reverberation)

(ii) තීව්‍රතාවය (I) වූ ධ්වනියක, හඬෙ සැර (s) අර්ථ දක්වන්න.

(iii) 'ශ්‍රව්‍යතා දේහලිය' ට $\left(I = 1\times10^{-12}\ \mathrm{Wm^{-2}}\right)$ සාපේක්ෂව හඬෙ සැරෙහි වෙනස (L - තීව්‍රතා මට්ටම) සඳහා ප්‍රකාශනයක් ලබා ගන්න.

(iv) $1.5\,\mathrm{kHz}$ සංඛ්‍යාතයෙන් යුතු ශබ්දයක් නිකුත් කරන ප්‍රභවයක් , $5\,\mathrm{m}$ දුරකදී ධ්වනි තීව්‍රතාව $0.75\mathrm{mW\,m^{-2}}$ ලෙස සටහන් කරයි. $25\,\mathrm{m}$ දුරකදී එම ශබ්දයේ තීව්‍රතා මට්ටම dB ඒකක වලින් ලබා ගන්න.

6. (i) X - කිරණ සහ ක්ෂුද්‍ර තරංග යනු මොනවාද?

(ii) ධ්‍රැවික ආලෝකය යනු කුමක්ද? ඒවා නිපදවන්නේ කෙසේද?

(iii) $2.2\,\mathrm{m}$ දුරක සිට $60\,\mathrm{W}$ ක්ෂමතාවෙන් යුතු ආලෝකයක් නිකුත් කරන ප්‍රභවයක් නිරීක්ෂණය කරයි. එය සියලු දිශාවන්ට සමවාරීව ආලෝකය නිකුත් කරන්නේ යැයි උපකල්පනය කරමින් එහි විද්‍යුත් හා චුම්භක ක්ෂේත්‍රවල වර්ග මධ්‍යන්‍ය මූල අගය ගණනය කරන්න.
(ආලෝකයේ ප්‍රවේගය $c = 3\times10^{8}\,\mathrm{ms^{-1}}, \mu_0 = 4\pi\times10^{-7}\,\mathrm{Hm^{-1}}$)

இலங்கை திறந்த பல்கலைக்கழகம்
விஞ்ஞானமானிப் பட்டப்படிப்பு –மட்டம் 03
இறுதிப்பரீட்சை– 2012/2013
பௌதீகவியலில் அலைகள்- PYU1162 / PYE 3162
காலம் - 2 மணித்தியாலம்

திகதி: 10.12.2013 **நேரம்: மு.ப 9.30 – மு.ப 11.30**

நான்கு வினாக்களுக்கு மட்டும் விடையளிக்க.

1. i) ஊக்கின் விதி மற்றும் இயக்கத்திற்கான நியூட்டனின் $2^{ம்}$ விதி என்பனவற்றை வரையறுக்க. (ஏதேனும் குறிகளை பயன்படுத்தின் அவற்றினை விளக்குக)

   ii) விற்சுருளில் இணைக்கப்பட்டுள்ள m திணிவுடைய துணிக்கை ஒன்றிற்கான எளிமை இசை இயக்கத்திற்கான சமன்பாட்டினை மேலே குறிப்பிட்ட விதிகளினை பயன்படுத்தி பெறுக. (விற்சுருள் மாறிலி k என்க)

   iii) இடப்பெயர்ச்சிக்கான எளிமை இசை இயக்கமானது $x= A \cos(\omega t+\alpha)$ எனத் தரப்படின் t நேரத்தில் துணிக்கையின் வேகம், ஆர்முடுகலை கணிக்க. (இங்கு $\omega^2=k/m$, A, α என்பன மாறிலிகளாகும்)

   iv) எளிமை இசை இயக்கத்தை ஆற்றும் ஒரு தொகுதியில் t=2s இல் 5cm இடப்பெயர்ச்சிற்கான , 10g திணிவுடைய துணிக்கையின் ஆர்முடுகல் $-20cms^{-2}$ ஆகும்.

   a) இயக்கத்திற்கான கோண வேகத்தை (ω) காண்க.
   b) துணிக்கையின் அதிகூடிய இயக்கசக்தியை காண்க. (துணிக்கையின் ஆரம்ப அவத்தை பூச்சியம் எனக்கொள்க)

2. i) $\pi/2$ அவத்தை வேறுபாடும் ஒன்றுக்கொன்று செங்குத்தாக காணப்படும் பின்வரும் எளிமை இசை இயக்கங்களின் விளையுள் சமன்பாட்டினை பெறுக.
   $x= a\cos(\omega t)$, $y= b \cos(\omega t + \pi/2)$, a,b என்பன மாறிலிகளாகும்.

   ii) லிசாசூ (Lissajous) உருவம் வரைதலின் விளைவு இயக்கத்தை விளக்குக.

   iii) விளைவு இயக்கத்தின் பாதையானது வட்டமெனின் , மேலே குறிப்பிட்ட இரண்டு இயக்கங்களின் அளவுருக்களை (Parameters) எவ்வாறு மாற்றுவீர்?

3. விற்சுருள் மாறிலி $k=20Nm^{-1}$ உடைய சீரான விற்சுருள் 0.2Kg திணிவுடன் இணைக்கப்பட்டுள்ளதுடன் சுருளிவில்லானது நிலைக்குத்தான உராய்வில்லாத தளத்தில் ஊசலாடுகிறது எனின்,

   i) திணிவின் அலைவினுடைய மீடிறனை காண்க.

   ii) மேலே குறிப்பட்ட தொகுதியில் -0.1v வெளிவிசையானது திணிவின் மேல் தொழிற்படும் போது (v- வேகம்) இயக்கத்திற்கான எண்மாறிலிகளுடனான (numerical constants) வகையீட்டு சமன்பாட்டை பெறுக.

   iii) மேலே குறிப்பட்ட இயக்கமானது அவத்தை கோணம் $\pi/2$ மற்றும் அலைவு வீச்சம் 0.12m உடன் ஆரம்பிக்கும் போது இயக்கத்திற்கான இடப்பெயர்ச்சியை எழுதுக.

   iv) இயக்கத்தின் வீச்ச வேறுபாட்டை சுருக்கமாக விளக்குவதுடன் அதனை நேரத்துடன் வரைந்து காட்டுக.

4. i) ஒலியின் தொப்ளரின் விளைவு என்பதனை சுருக்கமாக விளக்குக. இதன் மூன்று பிரயோகங்களை பெயரிடுக.

   ii) நிலையான அவதானியை நோக்கி V_S வேகத்துடன் அசையும் ஒலிமுதலானது f_S மீடிறனுடைய ஒலியை காலுகின்றது. தோற்ற மீடிறன் f_0 இற்கான சமன்பாட்டை பெறுக.(வளியில் ஒலியின் வேகம் V என்க)

   iii) நடைபாதையில் நிற்கும் நீங்கள் , உங்களை நெருங்கி வரும் அம்புலன்ஸின் (ambulance) ஊதுகுழலிருந்து 560Hz அதிர்வெண்ணை அவதானிக்கின்றீர்கள். அம்புலன்ஸ் உங்களை விலகி செல்லும் போது 480Hz மீடிறனானது உணரப்படுகின்றது எனின் அம்புலன்ஸின் வேகத்தை காண்க.

5. i) ஒலியின் பின்வரும் நிகழ்ச்சிகளை சுருக்கமாக விளக்குக.
   a) ஆக்கும் தலையீடு, அழிக்கும் தலையீடு
   b) எதிரொலி (Reverberation)

   ii) ஒலிசெறிவுக்கான (I) உரப்பு (S) (loudness S) இனை வரையறுக்குக.

   iii) ஒலியின் செறிவுமட்டத்திற்கான (L) சமன்பாட்டினை , கேள்தகவு நுழைவாயின் ஒலிச்செறிவு ($I_0= 1 \times 10^{-12} Wm^{-2}$) உடன் ஒப்பிடுவதன் மூலம் பெறுக.

iv) ஒரு ஒலி மூலமானது 1.5 kHz மீடிறனையும் 0.75 mWm^{-2} செறிவையும் கொண்ட ஒலியினை மூலத்திலிருந்து 5m தூரத்தில் உற்பத்தி செய்கிறது எனின் மூலத்திலிருந்து 25m தூரத்தில் ஒலியின் செறிவுமட்டத்தை dB இல் காண்க.

6. i) X-கதிர்கள் , மற்றும் நுண்ணலைகள் என்றால் என்ன?

ii) முனைவாக்கப்பட்ட ஒளி என்றால் என்ன? அது எவ்வாறு உற்பத்தி செய்யப்படுகின்றது?

iii) 2.2m தூரத்தில் 60W ஒளிமுதல் அவதானிக்கப்படுகிறது. மின் மற்றும் காந்த புலத்தில் rms இன் பெறுமானங்களை காண்க. மூலமானது எல்லா திசையிலும் சீராக கதிர்க்கின்றது என அனுமானிக்க.

(ஒலியின் வேகம் $C= 3 X 10^{8} ms^{-1}$, $\mu_0= 4\pi x 10^{-7} Hm^{-1}$)

The Open University of Sri Lanka
B.Sc. Degree Programme- Level 3
Final examination - 2012/2013
Waves in Physics – PYU 1162/PYE3162

Date : 10th December 2013 **Time : 9. 30 am – 11.30 am**

Answer any four (4) questions only

(1) (i) State the Hooke's law and Newton's 2nd law for motion. (Define the symbols if used)

(ii) Starting with the above laws , derive the equation for simple harmonic motion of a particle (mass m) which is attached to a spring (spring constant k).

(iii) If the displacement of a simple harmonic motion is given by $x = A\cos(\omega t + \alpha)$ find the velocity and acceleration of the particle at time t. Where $\omega^2 = \frac{k}{m}$, A and α are constants ,

(iv) In a system undergoing simple harmonic motion, the acceleration of a particle of mass 10 g is - 20 cms^{-2} for a displacement of 5 cm at time t = 2 s.

(a) What is the angular frequency (ω) of the motion?
(b) Find the maximum kinetic energy of the particle (assume that the initial phase of the particle is zero).

(2) (i) Obtain the resultant equation for the following simple harmonic motions which are perpendicular to each other and $\pi/2$ phase difference.

$x = a\cos(\omega t)$ and $y = b\cos(\omega t + \pi/2)$ where a and b are constants.

(ii) Describe the resultant motion drawing a Lissajous figure.

(iii) How do you change the parameters of the above two motions such that the path of the resultant motion is circular?

(3) A mass $m = 0.2\ kg$ is attached to a uniform spring of spring constant $k = 20\ N/m$ and oscillates on a vertical frictionless plane.

(i) Derive the frequency of the oscillation of mass.

(ii) If an external force $-0.1V$ acts on the mass (where V is the velocity)of the above system, obtain the differential equation with the numerical constants for the motion.

(iii) If the above motion (as in ii) initiates with the phase angle of $\pi/2$ and the amplitude of the oscillation is $0.12\ m$, write down the displacement of the motion.

(iv)Briefly describe the amplitude variation of the motion and sketch it with time.

(4) (i) Explain briefly what is meant by the Doppler Effect in sound. Name three applications of it.

(ii) Derive an expression for the observed frequency, f_o , when a source emitting a sound at frequency , f_s is moving with a velocity v_s towards a stationary observer hearing that sound. (consider the velocity of sound in air as V)

(iii) Standing on a pavement, you hear a frequency of 560 Hz from the siren of an approaching ambulance. After the ambulance passes, the observed frequency of the siren is 480 Hz. Determine the ambulance's speed from these observations

(5) (i) Briefly describe the following phenomena in sound

(a) Constructive and destructive interference
(b) Reverberation .

(ii) Define the loudness (S) for sound intensity (I).

(iii) Derive an expression for the intensity level of sound (L) compared to the threshold sound intensity of hearing ($I_0 = 1x\ 10^{-12}\ Wm^{-2}$)

(iv) A source of sound produces a sound with a frequency 1.5 kHz and intensity 0.75 mW m^{-2} at a distance of 5 m from the source. Find the intensity level of the sound in dB at a distance of 25 m form the source.

(6) (i) What are X- rays and micro waves?

(ii) What is polarized light and how are they produced ?

(iii) A light source with 60 W is observed at a distance of 2.2 m. Calculate the rms values of the electric and magnetic fields assuming that the source radiates uniformly in all directions (Velocity of light $C = 3 \times 10^8\ ms^{-1}$, $\mu_o = 4\pi \times 10^{-7}\ Hm^{-1}$)

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