UESTC Student ID_____ UOG Student ID_____ Course Title_____ Lecturer_____

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Glasgow College, UESTC

Physics I —Semester 2, 2018 - 2019

Final Exam

19:00-21:00, 25th June, 2019

Notice: Please make sure that both your UESTC and UoG Student IDs are written on the top of every sheet. This examination is closed-book. The use of a calculator is allowed, but the use of a cell phone is not permitted. All scratch paper must be adequately labeled. Unless indicated otherwise, answers must be derived or explained clearly. Please write within the space given below on the answer sheets.

All questions are compulsory. There are 7 pages, 7 questions and a maximum of 100 marks in total.

The following table is for grader only:

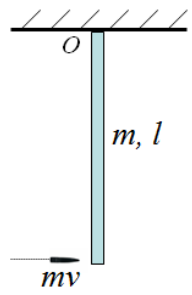
Question	1	2	3	4	5	6	7	Total	grader
Score									

Score

Question 1 Multiple-choice Questions (3×6=18 points)

Choose the ONE alternative that best complete the statement or answer the questions.

( ) 1. A bullet strikes into the edge of a hanging uniform rod as shown in figure. The rod begins to rotate after the collision, what is the angular velocity?



A) $\omega = \frac{v}{4l}$; **B)** $\omega = \frac{v}{2l}$; **C)** $\omega = \frac{2v}{3l}$;

D) $\omega = \frac{3v}{4l}$; **E)** $\omega = \frac{v}{l}$;

( ) 2. Which of the following statements is NOT correct about inertial forces?

A) They are not real forces.

B) Newton's second law can be modified in a noninertial frame if we consider the inertial forces.

C) In reference frame of a space station, the spaceman cannot feel gravity because it is balanced by inertial force.

D) Because of the inertial force, gravity of objects is slightly different from the gravitational force acted by the Earth.

E) In a rotational noninertial frame, there is only one inertial force acting on moving objects: Coriolis force.

( ) 3. A block–spring system vibrating on a frictionless, horizontal surface with amplitude of 6.0 cm has energy of 12 J. If the block is replaced by one who's mass is twice the mass of the original block and the amplitude of the motion is again 6.0 cm, what is the energy of the system?

A) 48J. B) 24J. C) 12J. D) 6J. E) 3J.

( ) 4. The intensity of an earthquake wave is measured to be $4.0\times10^5 W/m^2$ at a distance of 30km from the source. Then what is the intensity measured 10km from the source?

A) $4.4\times10^4 W/m^2$. **B)** $1.3\times10^5 W/m^2$. **C)** $4.0\times10^5 W/m^2 J$. **D)** $1.2\times10^6 W/m^2 J$. **E)** $3.6\times10^6 W/m^2 J$.

( ) **5. In the double-slit interference experiment, the distance between two slits is *d*, and the screen is *L* away from the slits. We can change the experiment condition to see what happens to the interference pattern. Which of the following statements is <u>NOT correct?</u>**

A) When the distance *d* increases, the interference fringes on screen are getting far away from each other.

B) When the distance *d* increases, the interference fringes on screen are getting brighter.

C) When the distance *L* increases, the interference fringes on screen are getting far away from each other.

D) Remaining other conditions, do the experiment under water; the interference fringes on screen will be closer to each other.

E) Colorful fringes can be seen if sunlight is used as the incident light.

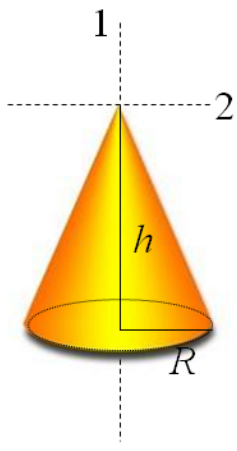
( ) **6. 600-nm light falls on a single-slit (width *a*=0.3mm), the screen is 2.0m away. At diffraction angle $\theta = 0.005\text{rad}$, which fringe can be observed?**

A) The first bright fringe. **B) The second bright fringe.**

C) The first dark fringe. **D) The second dark fringe.** **E) The third dark fringe.**

Score

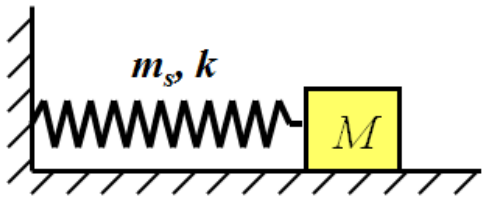
Question 2 Fill-in Questions (4×4=16 points)



1. A uniform cone (mass M) rotates about its symmetric axis 1, the rotational inertia I_1 = _____.

If it rotates about axis 2 (2⊥1, and passes the top of cone) the rotational inertia I_2 = _____.

2. Consider a massive spring (mass *m*, spring constant *k*), attached by an object *M*.



Determine the period of SHM. *T* =_____.

3. The original frequency of a guitar string is 200Hz. If the length of guitar string is decreased to 90% and the tension in the guitar string is increased to 110%, what will be the new frequency?

***f*= _____ Hz.**

4. The mixture of natural light and linearly polarized light falls on a Polaroid. If the axis of Polaroid rotates, the transmission intensity varies between I_0 and $5I_0$.

Then the incoming intensity of natural light is _____;

The incoming intensity of linearly polarized light is _____.

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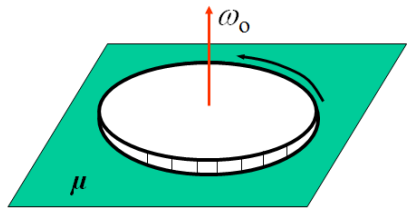
Question 3 (12+3=15 points)

A uniform disk (mass *M*, radius *R*) rotates at angular velocity ω_0 about its center axis. Then it is carefully placed on a rough ground (coefficient of friction μ). (a) When would it stop after contacting the ground? (b) How much work is done by friction?



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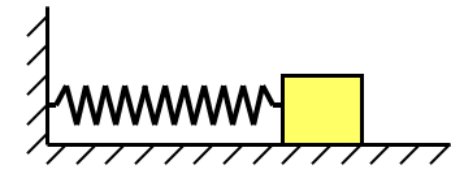
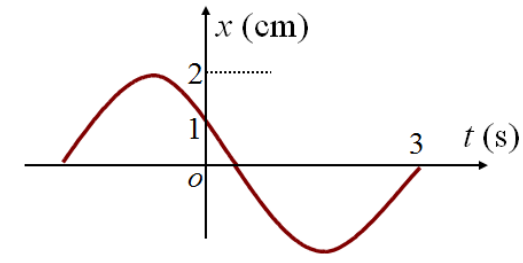
Question4 (9+3+3=15 points)

A mass-spring system (m=4kg) vibrates as a simple harmonic motion describing by the following figure. Determine: (a) the motional function *x*(t); (b) the spring constant *k*; (c) total mechanical energy *E* of the system.





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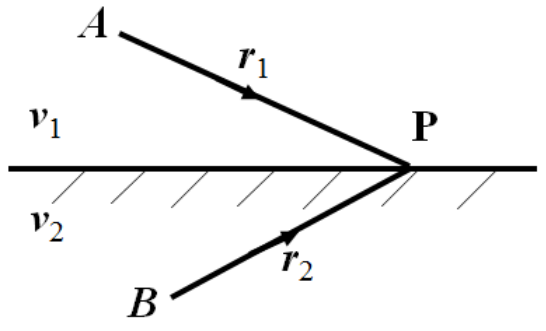
Question5 (10+6=16 points)

Two plane harmonic waves travel through different mediums (wave speed $v_1 = 400\text{m/s}, v_2 = 500\text{m/s}$) and meet at point P on the interface ($r_1 = 4\text{m}, r_2 = 3.75\text{m}$). As the wave passes, particle A moves as $y_A = 0.04\cos(200\pi t + \pi)$, and particle B moves as $y_B = 0.03\cos(200\pi t + \frac{\pi}{2})$. (a) What is the motional equation for point P? (b) If particle B moves as $y_B = 0.03\cos 200\pi t$, how much is the amplitude A at point P? (All quantities are in SI units)



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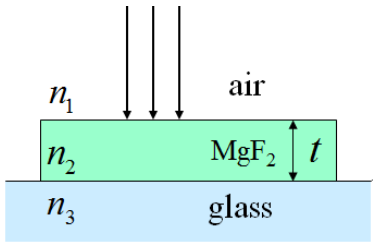
Question6 (4+6=10 points)

A film coating of MgF_2 (n_2=1.38) is designed to provide a reflection coating (strengthen the reflection light) for a glass optical component (n_3=1.50). As shown in the diagram, white light (400nm-700nm) is incident from air to glass (n_1=1). (a) What is the minimum thickness to strengthen reflection light at the wavelength of 600nm? (b) If the film coating is made of another material (n_2'=1.60), with the same thickness as obtained in case (a), which wavelength of light can be strengthened if white light falls on it?



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Question7 (5+5=10 points)

6500Å light falls on a grating. 2-nd lines can be seen at angle θ=30°, and 3-rd lines are missing.

(a) How much is grating constant *d*? (b) How many lines can be seen in total?