Umm Al-Qura University College of Applied Science Department of Physics Time: 10.15 - 12.15



جامعة ام القرى كلية العلوم التطبيقية قسم الفيزياء التاريخ: ١٧ ربيع الثاني ١٤٣٩

Final Exam

Academic Year 1438-1439 (1st Semester)

Program: Physics Course: Classical Mechanics (2) Course code: 403321-3

Question		Mark	Signature
Question 1	(10 marks)	Zero	
Question 2	(10 marks)	Zero	
Question 3	(10 marks)	Zero	100
Question 4	(10 marks)	Zero	festi
Question 5	(5 marks)	Zerro	
Question 6	(5 marks)	Zero	
Question 7			
Question 8]
Question 9			
Question 10			
Total Mark			Exam Committee
		Zero	Dr. Doaa Abdallah
		50	Dr. Fatma El-Sayed

	\rightarrow α Axis of rotation
Find the product of inertia and the angular momentum vector	L for
a thin rod of length l and mass m which is constrained to rotate	e with
constant angular velocity $\vec{\omega}$ about an axis passing through the	center
making an angle α with the rod.	
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L= Y/x L	= m(q) 2
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Question 2: (10 marks)

(a) A thin square plate of side *a* rotates freely under zero torque. If the axis of rotation makes an angle of 45° with the symmetry axis of the plate. Find the period of the precession of the axis of rotation about the symmetry axis, and the period of the precession of the symmetry axis about the invariable line. (5 marks)

X = y (a) d y f (b) A rigid body having an axis of symmetry rotates freely about a fixed point under no torques. If α is the angle between the axis of symmetry and the instantaneous axis of rotation, show that the angle between the axis of rotation and the invariable line is

$$tan^{-1}\left[\frac{(I_s-I)tan\alpha}{I_s+Itan^2\alpha}\right]$$

where I_s , the moment of inertia about the symmetry axis, is greater than I, the moment of inertia about an axis normal to the symmetry axis. (5 marks)

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a) Find the	acceleration o	f a solid uni	form sphere	rolling down	a nerfect	ly rough fixe	ed inclin
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lane. (5 ma	rks)						
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b) Find the m_1 and m_2 , M_{+}	acceleration of connected by , m_2 $m_1 = 1$	of an Atwood a light inext	t's machine tensible of le	system which ength <i>l</i> which p	consists ox	of two weighter a pulley.	hts of mark
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b) Find the m_1 and m_2 , M_1	acceleration of connected by $, m_2$ $m_1 = 1$ $L - m_1$	of an Atwood a light inext	t's machine tensible of le	system which ength <i>l</i> which p	consists ox	of two weighter a pulley.	hts of mark
b) Find the u_1 and m_2 , M_1	acceleration of connected by $m_1 = 1$ $L = m_1$	of an Atwood a light inext	d's machine tensible of le	system which ength <i>l</i> which p	consists passes ov \mathcal{O}	of two weighter a pulley.	hts of mark
b) Find the u_1 and m_2 , M_+	acceleration of connected by $m_1 = m_1$ $L = m_1$	of an Atwood a light inext	t's machine tensible of le	system which ength <i>l</i> which p	consists o	of two weighter a pulley.	hts of mark
b) Find the u_1 and m_2 , M_1	acceleration of connected by , m_2 $m_1 = 1$ $L = im_1$	of an Atwood a light inext	d's machine tensible of le	system which ength <i>l</i> which p	consists \mathcal{O}	of two weighter a pulley.	hts of mark
b) Find the u_1 and m_2 , M_+	acceleration of connected by $m_1 = m_1$ $L = m_1$	f an Atwood a light inext	t's machine tensible of le	system which ength <i>l</i> which p	consists o	of two weigh er a pulley.	hts of mark
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 Find the and m₂, M + 	acceleration of connected by $, m_2$ $m_1 = 1$ $L = im_1$	of an Atwood a light inext	d's machine tensible of le	system which ength <i>l</i> which p	consists passes ov	of two weigh er a pulley.	hts of mark
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Question	4:	(10)	marks)
Question	т.	(10	marks)

Find the Hamiltonian equations of motion for:

- 1- A one-dimensional harmonic oscillator.
- 2- A particle in a central field.

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Question 5: (5 marks)	
Deduce the relation between Impulse \hat{p} and coefficier	nt of restitution ε .
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Question 6: (5 marks) Prove that the position of the center of oscillation of the physical pendulum relative to the center of mass is $\ell' = \frac{k_{cm}^2}{2}$. Zeros fendulum: ٦ Kcm Ken