PH 1110, A Term 2009, 14 October 2009

Name: _____

Examination 4 (10:00 am)

Please circle your Section Number and Section Instructor.

1 Aravind (10:00) 2 Aravind (9:00) 3 Phillies 4 Keil 5 Dick (8:00) 6 Dick (1:00) 7 Iannacchione

This is a fifty-minute exam, with closed books and closed notes. You may use a calculator for numerical calculations. The exam will be graded out of one-hundred points. Show all of your work. If you require more space for writing, please use the back of the preceding page – the page facing the problem statement. Express numerical answers with units and with up to three significant digits, as appropriate. Please place your answers in the boxes provided.

- **Newton's Second Law:** $\sum \vec{F} = m\vec{a}$ **(Translational)** ; $\sum \tau = I\alpha$ **(Rotational)**
- $\omega = \frac{d\theta}{dt}$, $\alpha = \frac{d\omega}{dt}$, $v = \omega r$, $s = r\theta$, $g = 9.80\ m/s^2$
- Magnitude of tangential acceleration(a_t) = αr ; Radial acceleration (a_{rad}) = $\omega^2 r$,
- For α = constant,
  $\omega_f = \omega_i + \alpha t$; $\theta_f = \theta_i + \omega_i t + \frac{1}{2} \alpha t^2$;
- **Kinetic energy (K) :**
  (a) Translational K.E. (K_t) = $\frac{1}{2} mv^2$; (b) Rotational K.E. (K_{rot}) = $\frac{1}{2} I\omega^2$;
- The work done by a constant torque τ : $W_\tau = (\tau)(\Delta\theta)$
- **The Work-Energy Theorem:**
  $W_{total} = K_f - K_i$
- The M.I. of objects:
  (a) Point-mass and hoop: $I = mr^2$ (b) Uniform disk: $I = \frac{1}{2} mr^2$
  (c) Uniform rod/stick (about one end) : $I = 1/3\ ml^2$, where l is the length.
- **The conservation of energy:**
  $K_i + mgh_i + W_{other} = K_f + mgh_f$
- **Angular momentum of a rotating object:** $L = I\omega$
- **Angular momentum of a point mass in translation:** $L = m v r_\perp$
- If there is no external torque,
  $L_i = L_f$ **(Conservation of Angular Momentum)**

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