Marking scheme (Physics)

1st. Semester Exam – 2016

1. $V_1 : V_2 = 1 : 3$ ——— (1)

2. Put in to motion → static f. } ½ + ½
   maintain its motion → kinetic }

3. $P = \sqrt{2m \cdot KE} \Rightarrow P \propto \sqrt{m}$ } ½ + ½.
   Heavier body }

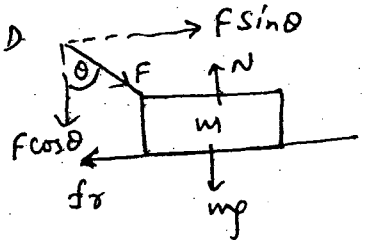
4. YES ——— ½
   No ——— ½

5. YES ——— 1.

6. $\frac{\Delta R}{R} \times 100 = \left(\frac{\Delta V}{V} + \frac{\Delta I}{I}\right) \times 100$ } ——— ½ } or only 25%.
   $= 25\%$ ——— 1 } = 2.

7. Centripetal accel^n $= \frac{v^2}{r} = 0.70\ m/s^2$ ——— 1 } 1+1.
   Net accel^n $= \sqrt{(0.7)^2 + (0.5)^2}$ ——— 1 }

8. F.B.D



——— 1

$N = mg + F\cos\theta$

$F\sin\theta = \mu [mg + F\cos\theta]$

$\therefore F = \left[\frac{\mu mg}{\sin\theta + \mu\cos\theta}\right]$ → ½ } (1 + ½ + ½).

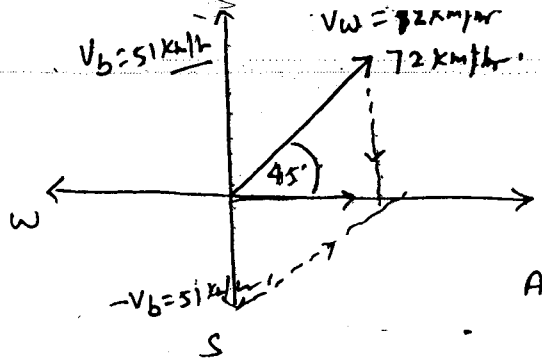
$\therefore \theta = \tan^{-1}(\mu)$ ——— ½

9. Conservative → Def^n + Example } — ½ + ½
   Non-conservative → " + " } — ½ + ½

10. statement ——→ 1 + Proof ——→ 1 } 1+1
    or
    Expression for $U_{sp} = \frac{1}{2} k x^2$ ——— (2).

11. $x = \frac{1}{2}$, $y = -\frac{3}{2}$, $z = \frac{1}{2}$ } ——— 3 · (½+½).
    Dim. formula — 1½ } calcul^n — 1½ }

12.



→ Dirn — 1.
E - Calcn — 2
} 1+2.

Ans → along East ward

13. $\vec{A} + \vec{B} = \hat{i} - \hat{j} + \hat{k}$ — $\frac{1}{2}$

$\vec{A} - \vec{B} = -5\hat{i} + 7\hat{j} - 9\hat{k}$ — $\frac{1}{2}$

$\vec{A} \cdot \vec{B} = -6 - 12 - 20 = -38$ — $\frac{1}{2}$

$\vec{A} \times \vec{B} = -\hat{i} - 2\hat{j} - \hat{k}$ — $1\frac{1}{2}$

} $\left(\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + 1\frac{1}{2}\right)$

14. (i) Av. Speed = $\frac{\text{total distance}}{\text{total time}} = \frac{120/2}{10} = \frac{60}{10} = 6\,m/s$ — 1.

(ii) Av. Speed = $\frac{\frac{1}{2}\left(12 + \frac{24}{5}\right)\times 3 + \frac{1}{2}\left(12 + \frac{48}{5}\right)\times 1}{4} = \frac{36}{4} = 9\,m/s$ — 2

} 1+2.

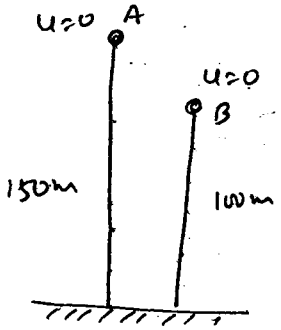
15. $(V_r)^2 = (u_r)^2 + 2a_r \cdot S_r$ —— 1.

$0^2 = (V_1 - V_2)^2 + 2(-a)\cdot S_r \Rightarrow S_r = \frac{(V_1 - V_2)^2}{2a}$ — 1.

For no collision, $S_r < d$ $\therefore$ $d > \frac{(V_1 - V_2)^2}{2a}$ — 1.

} 1+1+1.

16.



$h_A = 150 - \frac{1}{2}\times 10 \times 9$

$= 150 - 45 = 105\,m$

$h_B = 100 - 45 = 55\,m$

} 2

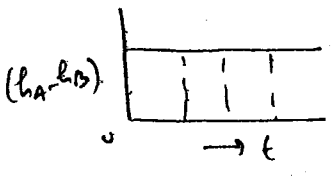
$h_A - h_B = (105 - 55) = 50\,m$ — $\frac{1}{2}$

graph with time = $\frac{1}{2}$

↓

Const parall to time axis.

} $(2 + \frac{1}{2} + \frac{1}{2})$



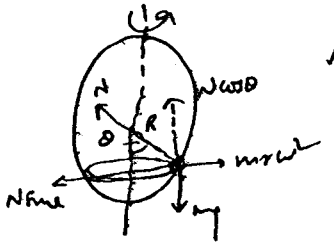
17. Defn — $\frac{1}{2}$

Reason — $\frac{1}{2}$ and Expn for $V_{max} = \sqrt{rg\left(\frac{\mu + \tan\theta}{1 - \mu\tan\theta}\right)}$ — 2

} $\frac{1}{2} + \frac{1}{2} + 2$.

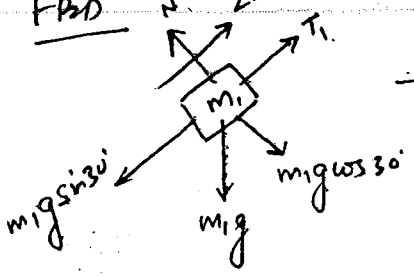
18. Prove of $n \le \frac{1}{2\pi}\sqrt{\frac{g}{r}} = 1$

when $n = \frac{1}{2\pi}\sqrt{\frac{2g}{r}}$ $\therefore$ $\theta = 60°$ } — 2

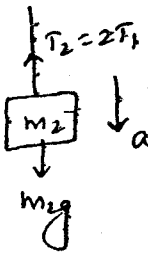


} 1+2

19. FBD



— $(\frac{1}{2})$



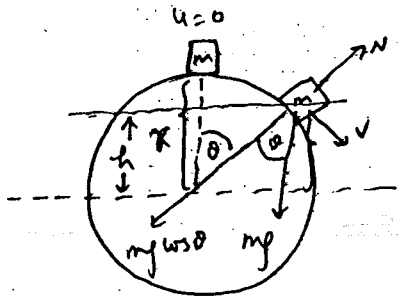
— $(\frac{1}{2})$

$T_1 - m_1 g \sin 30 = m_1 a$
$m_2 g - 2T_1 = m_2 a$ } — (1)

Calculⁿ of $a = \frac{1}{2}$ Calculⁿ of Tension $= \frac{1}{2}$

$(\frac{1}{2}+\frac{1}{2}+1+\frac{1}{2}+\frac{1}{2})$

20.



$mg\cos\theta = \frac{mv^2}{r}$ — 1.

$mgr(1-\cos\theta) = \frac{1}{2}mv^2$ — 1.

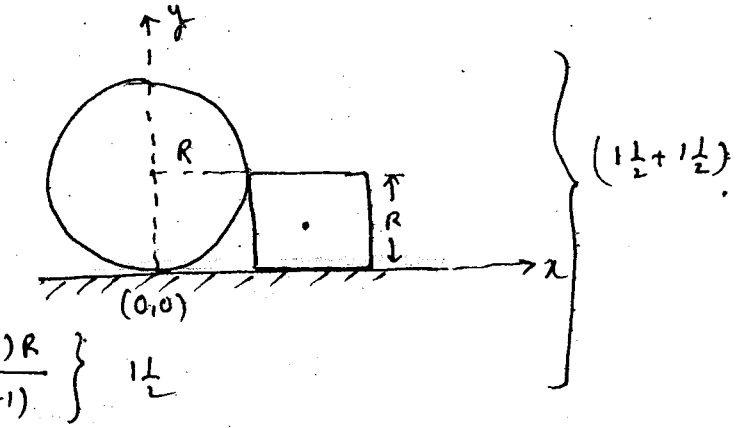
Calculⁿ of $\theta = \cos^{-1}(\frac{2}{3})$ — 1

1+1+1.

21. a. Centre of mass of Rectangular lamina — 1.
b. Co-ordinati of cm $= (\frac{5}{6}, \frac{5}{6})$ —— 2
(By any Method).

1+2.

22.



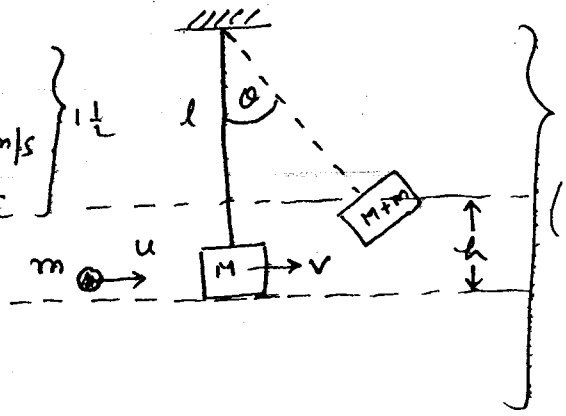
$x_{cm} = \frac{\pi R^2\sigma(0) + R^2\sigma \times \frac{3R}{2}}{\pi R^2\sigma + R^2\sigma} = \frac{3R}{2(\pi+1)}$ } $1\frac{1}{2}$

$y_{cm} = \frac{\pi R^2\sigma \cdot R + R^2\sigma \times \frac{R}{2}}{\pi R^2\sigma + R^2\sigma} = \frac{(2\pi+1)R}{2(\pi+1)}$ } $1\frac{1}{2}$

$(1\frac{1}{2}+1\frac{1}{2})$

22. $mu = (M+m)V$ —— 1.

$\therefore V = \frac{mu}{(M+m)} = \frac{0.012\times 70}{(0.4+0.012)} = 2\ m/s$ } $1\frac{1}{2}$



$(1\frac{1}{2}+1\frac{1}{2})$

A/c conv of energy $h = \frac{v^2}{2g}$

$h = \frac{4}{2\times 10} = \frac{2}{10} = 0.2\ m$ } $1\frac{1}{2}$

23. (a) 2 values → 2 Qualities → 2. (1+1)

(b) Body in contact and tendency to have rel. motion — 1.
By suitable lubricants, polishing, smoothness — 1

} 2+1+1.

24. Defⁿ of elastic & in-elastic — (figure) — (1+1).

Proof of $e = \frac{V_2 - V_1}{u_1 - u_2} = 1$ — 2

$V_1 = u_1$ & $V_2 = 0$ $\quad m_2 = m$ & $m_1 >>> m_2$ } 1

$V_1' = +2u_1$ & $V_2' = 0$

} (1+1+2+1)

OR

(a) Defⁿ — 1

$m_1 u = (m_1 + m_2) V$

$\frac{V}{u} = \frac{m_1}{m_1 + m_2}$

$\therefore \frac{KE_1}{KE_1'} = \frac{\frac{1}{2}(m_1 + m_2) V^2}{\frac{1}{2} m_1 u^2} = \left(\frac{m_1}{m_1 + m_2}\right)$

} (1+2)

(b) Deriv of collision in 1D for identical masses for $e = 1$ } 2.

$V_2 = u_1$ & $V_1 = u_2$

25 (a) Static frⁿ is self adjustable — 1

(b) $\theta \leq \tan^{-1}(\mu_s)$ — 2

(c) Pulling → N-decreases & f_r — decreases
Pushing → N-increases & f_r — increases } 2

} 1+2+2.

OR

(a) Newton 2nd law — 1 & $\int F \cdot dt = P_f - P_i = \Delta P$ — 1.

(b) Defⁿ of inertial & non-inertial — 1+1.
Explⁿ of concept of pseudo force — 1.

} 1+1+1+1+1

26 Eq^n of trajectory — 2 + Time of flight — 1 + Max^m height — 1 and Range — 1

} 2+1+1+1

OR

(a) Proof of $a = \frac{2s - 2v_0 t}{t^2}$ — (2)

(b) $s = ut + \frac{1}{2}at^2$ — $(1\frac{1}{2})$ & $v = u + at$ — $(1\frac{1}{2})$

} $2 + 1\frac{1}{2} + 1\frac{1}{2}$.