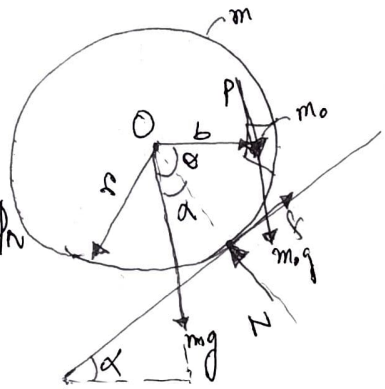
- NAME OF THE EXAMINATION: MID SEMESTER
- DATE OF EXAMINATION: 10-02-2021
- NAME OF THE SUBJECT: MECHANICS
- SUBJECT CODE: AM1101
- NAME OF THE STUDENT: TATHAGATA GHOSH
- EXAMINATION ROLL NUMBER: 20201TB065
- G SUITE ID: 20201TB065.TATHAGATA.STUDENTS.IIESTS.AC.IN
- NUMBER OF SHEETS UPLOADED

Ans 1 :)

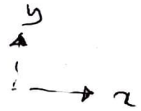


$P = [(0+6+5)\times 9.81]\,N$

$= (11\times 9.81)\,N$

$= 107.91\,N$

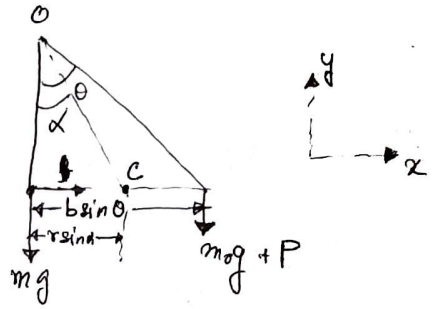
In Equilibrium,

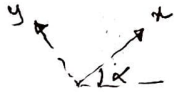


$\Sigma F_y = 0$

$\Rightarrow N\cos\alpha - mg - m_0g - P = 0$

$\Rightarrow N\cos\alpha = mg + m_0g + P$





$\Sigma F_x = 0$

$\Rightarrow N\sin\alpha - f = 0$

$\Rightarrow f - mg\sin\alpha - m_0g\sin\alpha + P\sin\alpha = 0$

$\Rightarrow f = (mg + m_0g + P)\sin\alpha$

$\Sigma M_c = 0$ ↻ +ve

$\Rightarrow (m_0g + P)(b\sin\theta - r\sin\alpha) - mg\sin\alpha\times r = 0$

$\Rightarrow (m_0g+P)b\sin\theta - (m_0g+P)r\sin\alpha = mgr\sin\alpha$

$\Rightarrow (m_0g+P)b\sin\theta = r\sin\alpha\,(m_0g+P+mg)$

$\Rightarrow \sin\theta = \dfrac{r\sin\alpha\,(m_0g+P+mg)}{b(m_0g+P)}$

$\Rightarrow \sin\theta = \dfrac{10\times\sin 15^\circ\,(20\times 9.81 + 107.91 + 40\times 9.81)}{8\,(20\times 9.81 + 107.91)}$

$\Rightarrow \sin\theta = \dfrac{1802.7}{2432.88}$

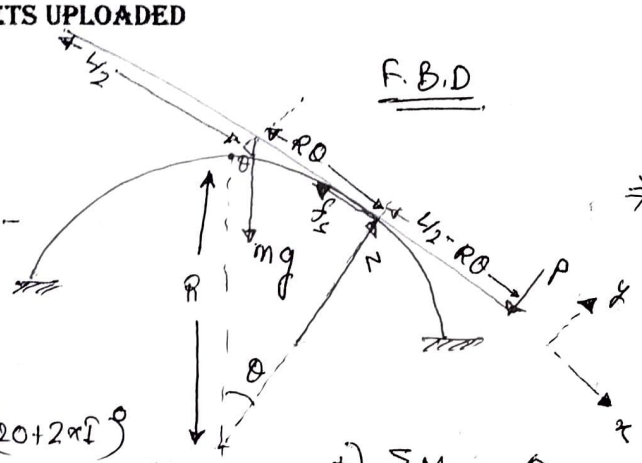
$\Rightarrow \theta = 47.81^\circ$ (approx) (Ans)

T. Ghosh

- NAME OF THE EXAMINATION: MID SEMESTER • DATE OF EXAMINATION: 10-02-2021
- NAME OF THE SUBJECT: MECHANICS
- SUBJECT CODE: AM1101
- NAME OF THE STUDENT: TATHAGATA GHOSH
- EXAMINATION ROLL NUMBER: 20201TB065
- G SUITE ID: 20201TB065.TATHAGATA.STUDENTS.IIESTS.AC.IN
- NUMBER OF SHEETS UPLOADED

Ans 20°)

Figure not to scale:-



F.B.D

To find: μ_s

Given: $\theta = (20+2\times 1)^\circ$

$= (20+2\times 5)^\circ$

$= 30^\circ$

In Equilibrium, We know that

$\Sigma F_x = 0$;

$\Rightarrow mg\sin\theta - \mu_s N = 0$ ---- (1)

$\Sigma F_y = 0$;

$\Rightarrow N - mg\cos\theta - P = 0$ ---- (2)

$\overset{+}{)}\ \Sigma M_0 = 0$

$\Rightarrow P\left(\frac{L}{2} - R\theta\right) - mg\cos\theta . R\theta = 0$ ---- (3)

From (1) $\Rightarrow N = \frac{mg\sin\theta}{\mu_s}$

From (2) $\Rightarrow \frac{mg\sin\theta}{\mu_s} - mg\cos\theta = P$

$\therefore N = \frac{mg\cos\theta . L}{L - 2\times 0.7L\theta}$

$= \frac{mg\cos\theta}{(1-1.4\theta)}$

Now, $P = \frac{mg\cos\theta}{1-1.4\theta} - mg\cos\theta$

From (1) $\Rightarrow \mu_s N = mg\sin\theta$

$\Rightarrow \mu_s = \frac{mg\sin\theta . (1-1.4\theta)}{mg\cos\theta} = (1-1.4\theta)\tan\theta$

$= \left\{1 - 1.4\times\left(\frac{30}{180}\right)\pi\right\} \times \tan 30^\circ$

$= 0.154$ (Ans)

From (3)

$(N - mg\cos\theta)\left(\frac{L}{2} - R\theta\right) - mg\cos\theta . R\theta = 0$

$\Rightarrow N.\frac{L}{2} - NR\theta - mg\cos\theta.\frac{L}{2} + mg\cos\theta . R\theta - mg\cos\theta R\theta = 0$

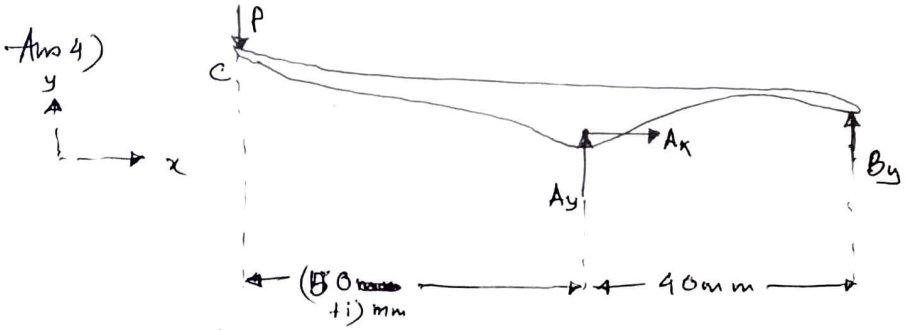
$\Rightarrow N\left(\frac{L}{2} - R\theta\right) = mg\cos\theta . L/2$

$\Rightarrow N = \frac{mg\cos\theta . L . 2}{2(L-2R\theta)} = \frac{mgL\cos\theta}{L-2R\theta}$

T. Ghosh

- NAME OF THE EXAMINATION: MID SEMESTER
- DATE OF EXAMINATION: 10-02-2021
- NAME OF THE SUBJECT: MECHANICS
- SUBJECT CODE: AM1101
- NAME OF THE STUDENT: TATHAGATA GHOSH
- EXAMINATION ROLL NUMBER: 20201TB065
- G SUITE ID: 20201TB065.TATHAGATA.STUDENTS.IIESTS.AC.IN
- NUMBER OF SHEETS UPLOADED

Ans 4)



$i = 065 \quad \therefore (50 + 65)\ mm = 115\ mm$

If $P = 0$;

$\Sigma M_C = 0$; ↻ +ve

$\Rightarrow B_y \times 155 - A_y \times 115 = 0$

$\Rightarrow B_y = \frac{115 \times 193.75}{155}$

$\Rightarrow B_y = 143.75N$ (Ans)

FBD of ABC,

In Equilibrium,

$\Sigma F_x = 0$

$\Rightarrow A_x = 0$

$\Sigma M_B = 0$; ↻

$\Rightarrow P \times (115 + 40) - A_y \times 40 = 0$

$\Rightarrow A_y = \frac{50 \times 155}{40}$

$\Rightarrow A_y = 193.75N$

T. Ghosh