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paper-2 — Marking Scheme

Dec-18, Backlog Exam

Q1 (a) Reaction $R_B = 15\,kN\uparrow$, $\overleftarrow{H_A = 20\,kN}$, $V_A = 5\,kN\uparrow$ — 1 mark

(1) $F_{CD} = 0$ (3) $F_{AD} = 5\,kN(C)$ (5) $F_{BD} = 25\,kN(C)$

(2) $F_{BC} = 0$ (4) $F_{AB} = 20\,kN(T)$ — 1 mark each

(1+5=6)

Q1 (b) FBD AB — 1 mark $F_{Ax} = \overleftarrow{24.83\,kN}$ — 1 mark

FBD CBD — 1 mark $F_{AY} = 25\,kN\uparrow$ — 1 mark

$F_{Dx} = \overleftarrow{1.15\,kN}$ — 1 mark

$F_{DY} = 10\,kN\uparrow$ — 1 mark

(2+4=6)

Q1 (c) (1) Frictional force is always tangential to contact surface and acts opposite to impending motion.

(2) $\mu_s = F_{max}(\text{Limiting})/N$ (normal reaction)

(3) Frictional force betn two rubbing surfaces is independent of area of contact.

(4) The value of frictional force increases as applied force increases till limiting value F_{max}.

(1 mark each = 4)

Q2 (a) Pass section through CE, ED, DF, Apply COE to RHS of truss, $\Sigma F_y = 0$, $-F_{DE}\sin 45 - 25 = 0$

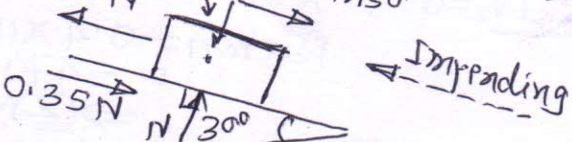
$F_{DE} = 35.35(C)$ kN — 2 marks

$\Sigma M_E = 0$, $F_{DF} \times 2 = 0$, $F_{DF} = 0$ — 2 marks

$\Sigma F_x = 0$, $-F_{CE} - F_{DE}\cos 45 - F_{DF} = 0$, $F_{CE} = 25\,kN(T)$ — 2 marks

2+2+2=6

Q2 (b) Smallest W_B FBD — 1 mark



$N - W_B\cos 30 = 0$

$W_B\sin 30 + 0.35N - 100 = 0$ — 1 mark

$W_B = 124.5\,N$ (small) — 1 mark

Largest W_B, block B slides down

FBD — (1) mark

$W_B\sin 30 - 0.35N - 100 = 0$

$N = W\cos 30$ — 1 mark

$W_B = 507.89\,N$ (largest) — 1 mark

3+3=6

slackside

Tight side > slack side, μ = coefficient of frict — 2 mark.

β = Angle of Lap

Q3 (a) use work Energy Principle, — 2 mark

$0 - \frac{1}{2}\,(100)\times 5^2 = -500 \times \frac{x^2}{2}$ — 2 mark

$-1250 = -250x^2$ — 2 mark

$x = 2.236\,m$

2+2+2=6

Q3 (b) P·E possed by body $= mgh = 10\times 9.81\times 100 = 9810\,N\text{-}m$

Velocity 50m, $10\times 9.81\times 100 = 10\times 9.81\times 50 + \frac{1}{2}\times 10\times V_2^2$

V_2 (50m) $= 31.32\,m/sec$ — 2 mark

Velocity 100 m (Ground) $= 10\times 9.81\times 100 = \frac{1}{2}\times 10\times V_3^2$

$V_3 = 44.3\,m/sec$ — 2 mark

(2+2=4)

Q3 (c) $F\cdot\Delta t = mV_2 - mV_1$, Impulse = change in momentum — 2 mark

F = large Force, Δt = small time,

m = mass, V_2 - Final velocity, V_1 = intial velocity — 2 marks

2+2 = 4

Q4 (a) $m_A = 25000\,kg$, $V_A = -0.75\,m/sec$ $m_B = 30{,}000\,kg$, $V_B = 0$

$V_A' = ?$ $V_B' = -0.36\,m/sec$.

conservation of Momentum $m_A V_A + m_B V_B = m_A V_A' + m_B V_B'$ — 2 mark

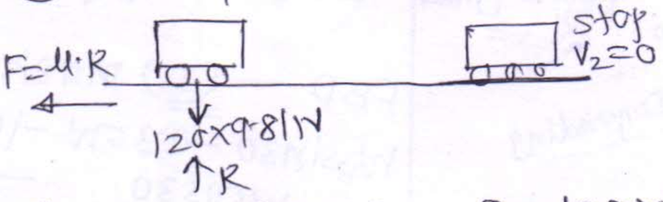
$V_A' = -0.318\,m/sec$. — 1 mark.

coefficient of restitution, $e = V_B' - V_A' / V_A - V_B =$ ~~0.056~~ — 2 marks.

$e = 0.056$ — 1 mark

(3+3=6.)

Q4 (b) $V_1 = 15\,m/sec = 54\,kmph$



$\Sigma F_y = 0$

$R = 120\times 9.81 = 1177.2\,N$

Friction $= -0.4\times 1177.2$
$= -470.88$
⇒ (2 marks)

$(-470.88)(\Delta t) = 0 - 120\times 15$ — Impulse momentum

$\Delta t = 3.82\,sec$ — 2 marks

(2+2=4)

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Forces — Initial K.E

$$F \times S = \frac{1}{2} m V_F^2 - \frac{1}{2} m V_i^2 \text{ — (2 marks)}$$

F = Force, s = displacement $F \times S$ = work
m = mass of body, V_f = Final velocity, V_i = initial velocity
— 2 marks

2 + 2 = 4

Q5. (a) (i) Resolution of force — (1)
(b) ~~(i)~~ (iv) equilibrium condition. — (1)
(c) (iv) Force — (1)
(d) (i) Tangential — (1)
(e) (i) 40KN — (2)
(f) (i) 3.1662, 3.605 — (2)
(g) (ii) 6.7, 13.3 — (2)
(h) (ii) equal, opposite — (2)
(i) (iii) 12.5, 93.75 — (2)
(j) (iv) mass, Acc^n — (2)
(k) (iii) 8.827 — (2)
(l) (i) 2.623 — (2)