MAY 2018/END SEMESTER EXAM

F. Y. B. TECH. (COMMON) (SEMESTER - II)

COURSE NAME: Engineering Mechanics

COURSE CODE: CV12175

(2017 PATTERN)

Solution and Marking Scheme

Corrected copy 8/5/2018

Paper Code - U127-106 (CESE)

Q.1

a)

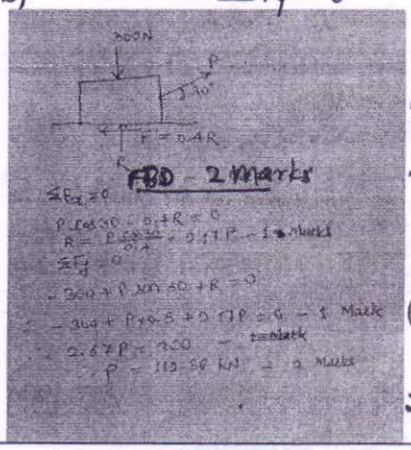
Vertical Reactions at A and B = 3.36 kN up and 0.96 kN down (**01 Mark**)

Sr. No.	Member	Force (kN)	Nature
1	AB	1.2	T
2	AC	3.36	C
3	AD	3.48	T
4	BC	2.52	C
5	CD	2.52	C

Table- **05 Marks**

b)

$\Sigma F_y = 0$



$\therefore N_1 = 300 - 0.5P$ (1 mark)

$\Sigma F_x = 0$

$\therefore P\cos 30° - 0.4(300 - 0.5P) = 0$ (1 mark)

$(0.866 + 0.2)P = 120$ (1 mark)

$\therefore P = 112.5$ N (1 mark)

c)

i) Trusses are axial members only
ii) Loads are acting at joints only
iii) Joints are hinge joints
iv) Self weigh is negligible

01 Mark for each correct assumption

Q.2

a) R_A=9.91kN, R_B= 17.41kN, H_A= 10kN- **01 mark**

Table- **05 marks**

Sr. No.	Member	Force(kN)	Nature
1	AC	16.52	C
2	AD	23.22	T
3	CD	10.00	T
4	BD	23.22	T
5	BC	29.02	C

b) Use I.M.P. $(P - F)t = m(v - u)$

Total Frictional force OR

=7.2 x 25000/1=18000 N- **01 Mark**

V_0= 40 kmph= 11.11 m/s- **01 Mark**

V= 60 kmph= 16.67 m/s- **01 Mark**

$V = V_0 + at$

a= 0.037 m/s^2- **01 Mark**

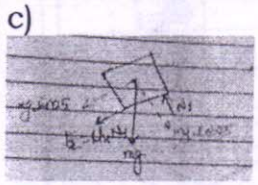
$m = W/g$= 2500 x 10^3/9.81

= 254.842 kg- **01 Mark**

ΣF_x= ma

P=ma + F= 27.43 kN- **01 Mark**

c)



FBD- **01 Mark**

KE1 + Work done by all forces = KE2

KE2=0- **01 Mark**

Correct x or s 1 mark

Correct t (P.T.O.) 1 mark

Q.2(c)

From FBD, $N1 = mg \cos 25$
$Fr = \mu k\, mg \cos 25$
$0.5mX152 - (mg \sin 25) \times s - (\mu k\, mg \cos 25) \times s = 0$
$s = 17.665$ m **01 Mark**
t= Avg. velocity x Time = 2.355 s- **01 Mark**

Q.3
a) $m_A = 20/9.81 = 2.04$ kg, $m_B = 10/9.91 = 1.02$ kg- **01 Mark**
$m_AV_A + m_BV_B = m_AV_{AF} + m_BV_{BF}$
$2.04 \times 6 + 1.02 \times (-8) = 2.04V_{AF} + 1.02V_{BF}$
$2.04V_{AF} + 1.02V_{BF} = 4.08$- **02 Marks**
$e = (V_{BF} - V_{AF})/(V_A - V_B)$
$0.6 = (V_{BF} - V_{BA})/(6+8)$
$V_{BF} - V_{AF} = 8.4$- **01 Mark**
$V_{AF} = -1.47$ m/s, $V_{BF} = 6.93$ m/s- **02 Marks**

b)
$m_A = 0.8/9.81 = 0.0815$ kg, $V_A = 300$ m/s- **01 Mark**
$m_B = 50/9.81 = 5.097$ kg, $V_B = 18$ m/s
$m_AV_A + m_BV_B = (m_A + m_B)V$ - **01 Mark**
$(0.0815 \times 300) + (5.097 \times 18) = (0.0815 + 5.097) \times V$
$V = 22.438$ m/s - **01 Mark**
KE lost by bullet $= 0.5 \times 0.0815 \times (300)^2 - 0.5 \times 0.0815 \times (22.438)^2$
$= 3647$ J - **01 Mark**

c) Work Energy Principle- **02 Marks**
Example- **02 Marks**

Q.4
a)
Let R be the resistance force.
By Work-Energy Principle,
KE1 + Work done by all forces = KE2
For the block, $KE1 = 0.5 \times (1/8) \times 150^2 = 1406.25$ J- **01 Mark**
Work done by $R = -R \times 0.125$
$KE2 = 0$
$1406.25 - R \times 0.125 = 0$
$R = 11250$ N- **02 Marks**
For the board, let V be the velocity with which bullet emerges.
$1406.25 - 11250 \times (60 \times 10\text{-}3) = 0.5 \times (1/8) \times V^2$
$V = 108.17$ m/s- **03 Marks**

b)
Since the initial velocity is zero, the velocity with which the hammer falls on the pile is
$V = \sqrt{(2gh)} = \sqrt{(2 \times 9.81 \times 6)} = 10.85$ m/s- **01 Mark**
Change in momentum
=Mass x Change in velocity
$= 250 \times (10.85 - 0)$
=2712.5 N-s- **01 Mark**
Impulse = 2712.5 Ns
F x t= 2712.5 - **01 Mark**
Avge. Force F= 2712.5/0.012
= 226.04 kN- **01 Mark**

c)
Let suffix s and t refer to suitcase and trolley respectively. Applying the principle of conservation of momentum to the trolley-suitcase system, we have
$m_s(V_s)_1 + m_t(V_t)_1 = m_s(V_s)2 + m_t(V_t)_2 = (m_s + m_t) \times V$- **02 Marks**
$10 \times 4 + 25 \times 0 = (10+25) \times V$- **01 Mark**
V= 40/35= 1.14 m/s- **01 Mark**

MCQ's

Q. No.	Ans	Q. No.	Ans
a	iv	i	Any Ans-correct*
b	iv	j	i
c	iii	k	i
d	iii	l	i
e	i		
f	iii		
g	iii		
h	iii		

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8/5/18

* None of i through iv are correct.