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SET A

# UNIVERSITI KUALA LUMPUR
## Malaysia France Institute

## FINAL EXAMINATION

## SEPTEMBER 2013 SESSION

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|---|---|---|
| **SUBJECT CODE** | : | **FMB 20202** |
| **SUBJECT TITLE** | : | **MECHANICS OF MACHINES** |
| **LEVEL** | : | **BACHELOR** |
| **TIME / DURATION** | : | **2.5 HOURS** |
| **DATE** | : | |

**INSTRUCTIONS TO CANDIDATES**

1. **Please read the instructions given in the question paper CAREFULLY.**
2. **This question paper is printed on both sides of the paper.**
3. **Please write your answers on the answer booklet provided.**
4. **Answers should be written in blue or black ink except for sketching, graphic and illustration.**
5. **This question paper consists of ONE (1) section. Answer FOUR (4) questions only.**
6. **Answer all questions in English.**
7. **Formula sheet is appended**

**THERE ARE 4 PAGES OF QUESTIONS AND 1 PAGE OF APPENDIX, EXCLUDING THIS PAGE.**

**INSTRUCTION: Answer only FOUR (4) questions.**
**Please use the answer booklet provided.**

**Question 1**

(a) A car moving at 10 km/h suddenly accelerates uniformly to 40 km/h in 10 seconds. Calculate the acceleration, the average velocity and the distance travelled.

(10 marks)

(b) A wheel rotates $180^o$ in 6 seconds. Calculate:

(i) The angle turned in radian
(ii) The angular velocity in radian per second

(5 marks)

(c) A car of mass 1 000 kg moves at 3 m/s along a level track into a stationary car of mass 1 200 kg. If both cars a coupled together after the impact, determine their common velocity. Also, calculate the kinetic energy that was lost after the impact.

(10 marks)

**Question 2**

One vehicle with the mass of 1000 kg move at flat ground with the gear number 2. The ratio of gear number 2 is $\frac{3}{4}$ and efficiency of meshing gear is 95%. Moment of inertia at part of engine with rotation is 0.25 kg $\mathrm{m}^2$ and for wheel 0.7 kg $\mathrm{m}^2$. Radius of wheel is 0.75 m. If the resistant of air is 800 N, and if the acceleration is 0.8 m/$s^2$. Please refer to the Figure 1.

(a) Calculate the tractive force (Ft).

(12 marks)

(b) Determine the torque of engine.

(13 marks)

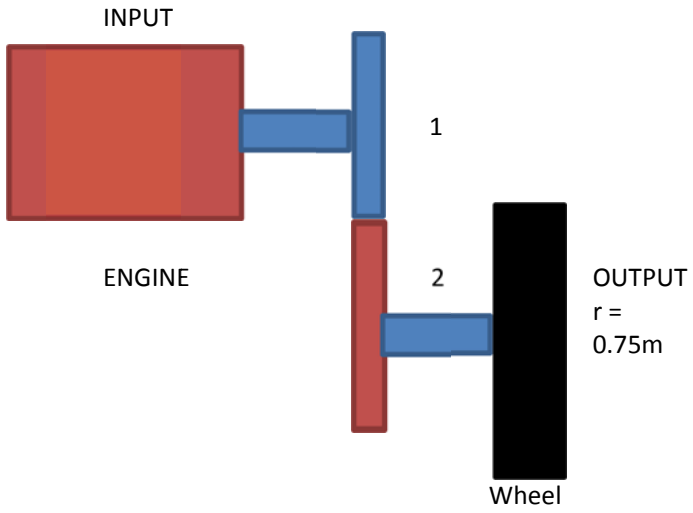


Figure 1

**Question 3**

If Shaft Input (I) is rotated with 600 rpm and gear outer has been locked. Number of teeth = 40, = 50, inside) = 80, outside) = 120, (inside) = 100, (outside) = 120, and m = 20. Please refer to the Figure 2.

(a) Analyze free rotation table.

(8 marks)

(b) Compute speed and direction rotation of shaft 0

(5 marks)

(c) Calculate speed and direction rotation of gear

(4 marks)

(d) Determine speed and direction rotation of gear

(8 marks)

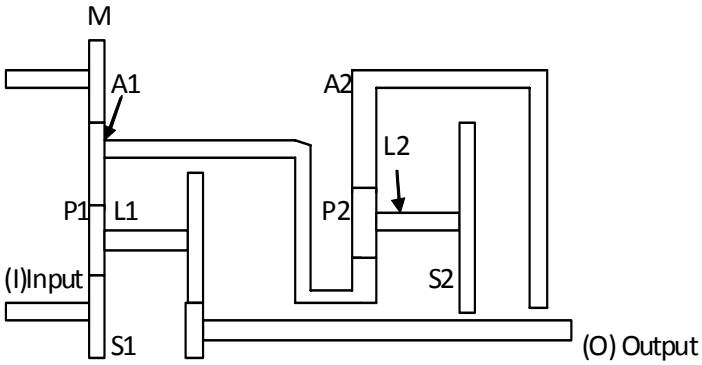


Figure 2

**Question 4**

As an Engineer, you need to determine the power transmitted occur when a laminated belt 8 mm thick and 150 mm wide drives a pulley of 1.2 m diameter at 180 rpm. The angle of lap is 190° and density of the belt material is 1000 kg/m³. If the stress in the belt is not to exceed 1.5 N/mm² and the coefficient of friction between the belt and the pulley is 0.3. Determine the power transmitted when the centrifugal tension is

(a) Considered, and

(12 marks)

(b) Neglected.

(13 marks)

**Question 5**

A rotating shaft carries four masses, A, B, C and D, rigidly attached to it. The mass radii are 30 mm, 36 mm, 40 mm and 32 mm respectively. The mass of A, C and D is 8 kg, 5 kg and 3 kg respectively. Please refer to the Figure 3.

(a) Analyze data using table.

(6 marks)

(b) Draw moment polygon diagram, find the value of x

(6 marks)

(c) Draw polygon force diagram.

(6 marks)

d) Calculate the mass of B and the location angle β for B and location angle θ for D so that the system of masses becomes balance.

(7 marks)

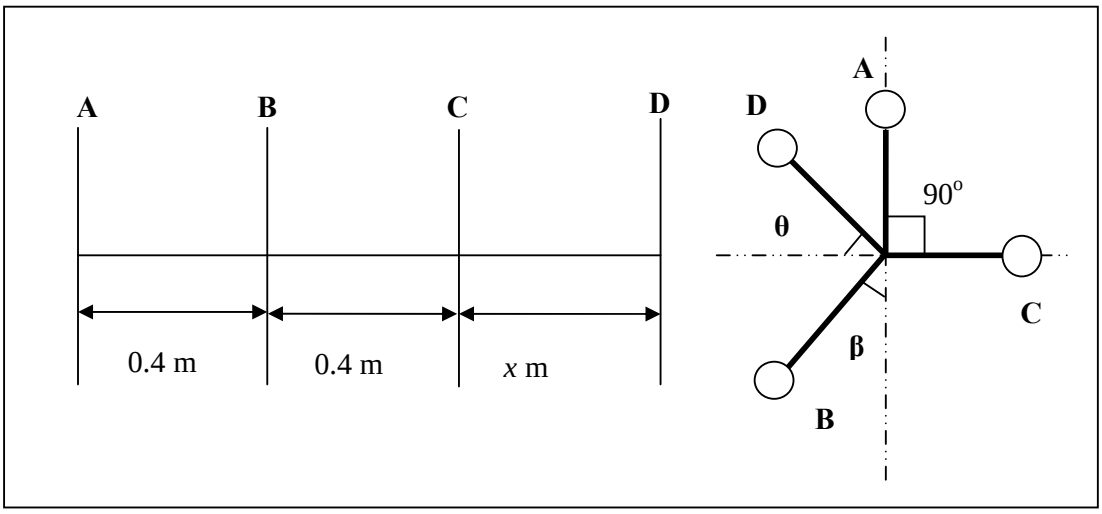


Figure 3

**END OF QUESTION**

## APPENDIX

### List of formula

$v = u + at = \omega r$

$P = Fv$

$P = (T_1 - T_2)v$

$F = m\omega^2 r$

$T = mv^2 = P/\omega$

$(T_1 - T_C) / (T_2 - T_C) = e^{\mu\theta}$

$v_2/v_1 = 1 - [(T_1 - T_2) / aE]$

$G.R. = N_A / N_B = T_B / T_A$

Max Tension in the belt, T=f.b.t

mass of the belt per metre length, m= Area x Length x density

centrifugal tension, $T_1 = m.v^2$

$$(I_{eq})_m = I_m + \frac{(n\ ½)^2\ I_i}{\eta_{1/2}} + \frac{(n\ ½.\ n\ ¾)^2 I_h}{\eta_{1/2}.\eta_{3/4}}$$

$Tm = T_{m1} + T_{m2} + T_f$

$P_m = T\omega$

$T_m = (I_e)_m \times \alpha_m$