

HND/C PHASE TEST SPECIFICATION

Programme:	HND Automotive Engineering / Motorsport Engineering				
Unit:	Mechanical Principles				
Phase Test No:	2	Lecturer:	T Tudor	Internal Verifier:	A Summerfield

Time and Date:	2012	Duration:	90 mins	Contribution to Overall Unit Assessment (%):	25%
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Outcomes being Assessed (from Unit Syllabus):	
Number	Description
Learning Outcome 3:	Investigate power transmission system elements
Learning Outcome 4:	Investigate the dynamics of rotating systems

For Attention of Students:

Answer **ALL** questions.

The mark allocation is as indicated – total 40 marks.

A ‘formula sheet’ is provided for reference.

Assume ‘g’ = 9.81 m/s².

and 1 bar = 10⁵ N/m² (P_a)

1. Calculate:

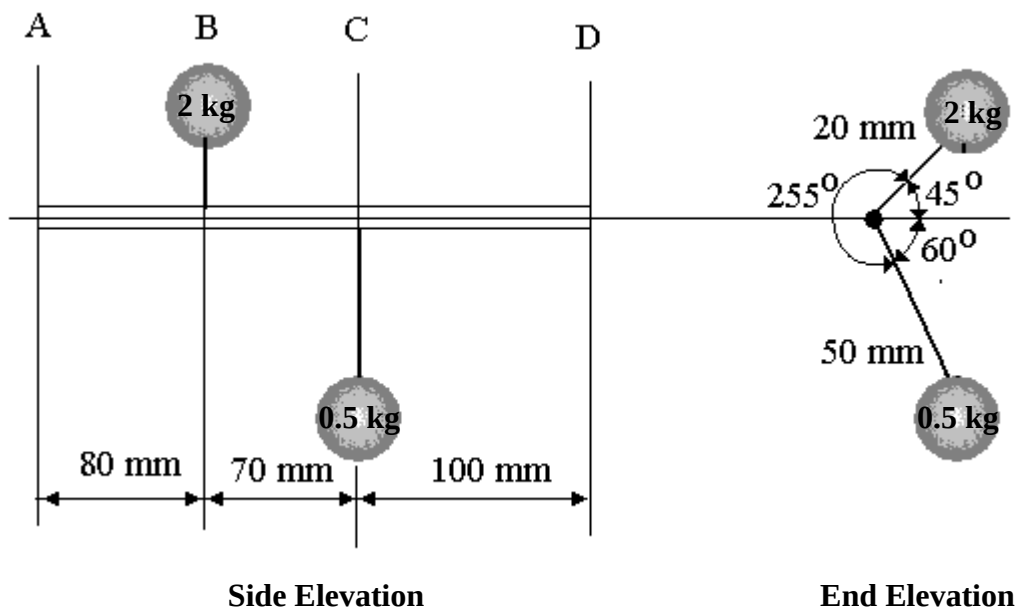
- i) The maximum torque and power which can be transmitted at 2000 RPM by a brand new clutch if it has an outer diameter of 120mm, an inner diameter of 40mm and a coefficient of friction of 0.45. The axial force may be taken as 800N.
(5 marks)
- ii) The maximum torque and power which could be transmitted by the same clutch at 2000 RPM when worn by 1.3mm, if the axial force is provided by 4 springs, each with a rate of 15 N/mm.
(5 marks)

2. A belt drive must transmit 8 kW of power at 5000 rev/min. The pulley wheel is 120 mm diameter and the coefficient of friction is 0.3. The lap angle is 115° . If the initial belt tension must not exceed 180 N calculate;

- i) The linear velocity of the belt (2 marks)
- ii) The maximum and minimum belt tension when transmitting power (5 marks)
- iii) The power transmitted per belt (1 mark)
- iv) the minimum number of belts required. (2 marks)

Take the belt mass to be negligible.

3. The diagram below shows masses on two rotors in planes B and C, 2kg at a radius of 20mm and 0.5kg at a radius of 50mm, respectively. Determine the masses and their positions, to be added on the rotors in planes A and D at radius 30 mm which will produce static and dynamic balance.

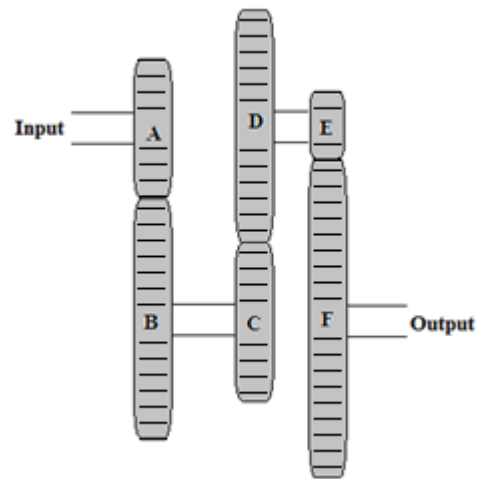


PTO

- Construct a table to calculate the magnitude of the forces and moments created by the rotating masses
(2 Marks)
- Construct a vector diagram using a suitable scale to represent the resultant moment (mr_x polygon) and calculate mass D and its position
(4 Marks)
- Construct a vector diagram using a suitable scale to represent the resultant force (mr polygon) and calculate mass A and its position
(4 Marks)

4. The diagram below shows a compound gear train.

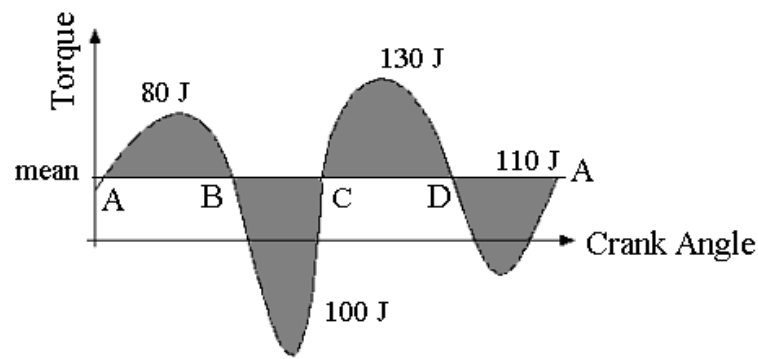
Gear A has 24 teeth
Gear B has 36 teeth
Gear C has 28 teeth
Gear D has 32 teeth
Gear E has 12 teeth
Gear F has 54 teeth



Gear A is the input gear and revolves at 1900 rev/min anticlockwise when viewed for the left end. If the input torque is 18 Nm and the gear train efficiency is 76% calculate the following;

- a) the output speed and direction (4 Marks)
- b) the output power and torque (4 Marks)
- c) the holding torque required (2 Marks)

5. The diagram shows a torque - angle diagram for a certain machine.



If the speed of the shaft must be maintained between 500 and 550 rev/min, calculate;

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|----|---|-----------|
| a) | the coefficient of fluctuation of speed | (2 Marks) |
| b) | the maximum fluctuation of energy (βW) | (3 Marks) |
| c) | the moment of inertia of a suitable flywheel. | (3 Marks) |
| d) | the radius of gyration of the flywheel if it has a mass of 13 kg. | (2 Marks) |

END OF TEST