

## EE 3112 TUTORIAL SHEET

July 2016

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### Question 1

A beam, which is supported through pin joints at its ends, is acted upon by a couple  $M$  in a plane containing the axis of the beam, applied at a point two thirds of the span from one end. Find expressions for the slope of the beam at both ends, and the maximum deflection.

### Question 2

Compare the weights of equal lengths of hollow and solid shaft to transmit a given torque for the same maximum shear stress, if inside diameter is  $\frac{3}{4}$  of the outside.

### Question 3

A solid 2m shaft of radius 60 mm and density  $4 \text{ g/cm}^3$  carries 4 unbalanced masses spaced as follows:

Masses A, B, C, and D are 10, 12, 10, and 12kg respectively, rotating at radii 12, 10, 12, 10cm respectively, and spaced from one end of the shaft at 30, 45, 60, and 75 cm respectively. the angular spacing from A to B, C, and D are  $60^\circ$ ,  $120^\circ$ , and  $180^\circ$  respectively.

- Balance the shaft using two 11 kg masses at either end
- If before balancing, the shaft rotated at 2000 rpm what will be its rotation after balancing.
- If all masses are removed from the shaft and the power transmitted is 122 kW, determine the maximum shear stress on the shaft.

Note: Uniform disc or cylinder, radius  $r$ .  $I$  about the central axis is  $\frac{mr^2}{2}$  and  $k = \frac{r}{\sqrt{2}}$

### Question 4

You are designing the spring damper system for a 825 kg motor rally vehicle. The test road is sinusoidally undulated with a maximum displacement of 25cm. If the maximum allowable displacement of the vehicle relative to the road is 32cm, determine:

- the damping ratio and state whether it is over, critically or under damped

If the length of one undulation is 4m, and the damping coefficient is 7600kg/s, determine:

- the stiffness of the suspension
- the speed in km/h of the vehicle at maximum displacement
- the maximum displacement of the vehicle if the and the vehicle is moving a 220km/h