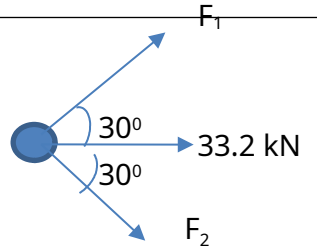
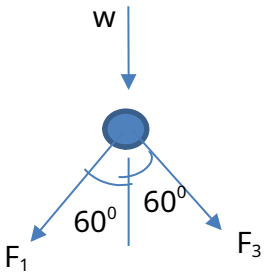
UNIVERSITI TEKNOLOGI MARA
TEST 1

COURSE	**:**	**MACHINE ELEMENT DESIGN**
COURSE CODE	**:**	**MEC331**
EXAMINATION	**:**	**JUN 2019**
TIME	**:**	**3 HOURS**

Question 1

Answer:	Marks
$d_r = d - p = 36 - 6 = 30\,mm$	0.5 marks
$d_m = \frac{d + d_r}{2} = \frac{36 + 30}{2} = 33\,mm$	1 marks
$\tan\lambda = \frac{L}{\pi d_m} = \frac{2\,x\,6}{33\,x\,\pi} = 0.1157$	1 mark
$N = \frac{V}{L} = \frac{48}{12} = 4\,rps$	1 mark
$P = 2\,\pi NT$ $3\,x\,10^3 = 2\,\pi\,(4)\,T$ $T = 119.4\,Nm$	2 marks
$\alpha_n = 0^o$ $T_u = \frac{W\,d_m}{2}\left(\frac{f + \tan\lambda}{1 - f\tan\lambda}\right)$ $119.4 = \frac{W\,(0.033)}{2}\left(\frac{0.1 + 0.1158}{1 - (0.1)(0.1158)}\right)$ $W = 33.2\,kN$	0.5 marks 1 mark 1 mark
 $\sum F_y = 0 \ldots\ldots F_1 \sin 30 - F_2 \sin 30 = 0$ $F_1 = F_2$ $\uparrow \sum F_X = 0 \ldots . F_1 \cos 30 - F_2 \cos 30 - 33.2k = 0$ $F_1 \cos 30 - F_1 \cos 30 - 33.2\,k = 0$ $2\,F_1 \cos 30 = 33.2k$	1 mark 1 mark 1 marks

$F_1 = 19.17\,kN$	2 marks
 $\sum F_x = 0 \ldots\ldots F_1 \sin 60 - F_3 \sin 60 = 0$ $F_1 = F_3$ $\uparrow \sum F_y = 0 \ldots . - F_1 \cos 60 - F_2 \cos 60 - W = 0$ $F_1 \cos 60 + F_1 \cos 60 = -W$ $-2F_1 \cos 60 = W$ $W = -19.17\,kN$	1 mark 1 mark 1 mark 2 marks
$T_u = F\,x\,l$ $119.4 = 500\,x\,l$ $l = 0.2388\,m$	2 marks
Total	**20 marks**

Question 2

Answer:	**Marks**
$e = 300 + 150 = 450\,mm$ $M = Pe = 20\,k \sin 60\,x\,450 = 7794\,kNmm$ $r_1 = r_2 = r_3 = r_4 = 150\,mm$	1 mark 1 mark 1 mark

$$\sum r^2 = 90000\,mm^2$$

1 mark

Bolt 3

F_{t3}

F_{dx3}

1 mark

F_{dy3}

$$F_{t3} = \frac{7794\,k\,x\,150}{90000} = 12.99\,kN$$

1 mark

$$F_{dx3} = \frac{20\,k\,x\cos 60}{4} = 2.5\,kN$$

1 mark

$$F_{dy3} = \frac{20\,k\,x\sin 60}{4} = 4.33\,kN$$

1 mark

$$\rightarrow \sum F_X = -2.5\,kN$$

$$\uparrow \sum F_Y = -12.99\,k - 4.33\,k = -17.32\,kN$$

1 mark

$$R_3 = \sqrt{(-2.5\,k)^2 + (-17.32\,k)^2} = 17.5\,kN$$

1 mark

1 mark

Bolt 4

F_{dx4}

1 mark

$$F_{t4} = \frac{7794\,k\,x\,150}{90000} = 12.99\,kN$$

$$F_{dx4} = \frac{20\,k\,x\cos 60}{4} = 2.5\,kN$$

1 mark

$$F_{dy4} = \frac{20\,k\,x\sin 60}{4} = 4.33\,kN$$

1 mark

$$\rightarrow \sum F_X = -2.5\,k - 12.99\,k = 15.49\,kN$$

1 mark

$$\uparrow \sum F_Y = -12.99\,kN$$

$$R_4 = \sqrt{(-15.49\,k)^2 + (-12.99\,k)^2} = 16.08\,kN$$

1 mark

$$max\ shear = \frac{R_3}{A} = \frac{17.5\,k}{\frac{\pi(0.014)^2}{4}} = 113.7\,MPa$$

1 mark

2 marks

Total	**20 marks**