B.E. (Mechanical Engineering / Power Engineering) Semester Seventh (C.B.S.)

Design of Mechanical Drives

P. Pages : 3 **KNT/KW/16/7476/7522**

Time : Three Hours * 0 8 7 1 * Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Assume suitable data whenever necessary.
7. Illustrate your answers whenever necessary with the help of neat sketches.
8. Use of Design Data book is permitted.

1. a) Design a bush pin type of flexible coupling for connecting the 9 kw motor running at 1440 rpm to centrifugal pump. **8**

b) The details of hydrodynamic bearing for a diesel engine Crankshaft are given below. **12**
Maximum load on bearing = 35 kN
Speed = 1440 RPM;
Dia. of Crank shaft = 100 mm
Clearance ratio (C/R) = 0.001
Viscosity of oil = 25 Cp
Minimum film thickness h min = 0.03 mm
Inlet oil temperature ta = 35ºC
Determine :
i) The bearing pressure
ii) Length of bearing
iii) Frictional power loss
iv) Quantity of oil required in liters/min.
v) Out oil temperature

2. a) A multi cylinder engine is to run at a constant speed of RPM in the $T - \theta$ diagram the areas above and below the mean torque line in mm^2 are as follows. **10**
$+170; -182; +178; -201; +207; -172$
The scales for the diagram are for torque 1 mm = 250 N.m and for Crank angle 1 mm = 3 degree. The speed is to be kept $\pm$ 3% (percent) of the mean speed of the engine. Design the suitable C.I. flywheel for the engine.

b) Select a suitable ball bearing with 60% reliability for the following loading condition. The bore diameter is 80 mm. Life is 25000 hours. **10**

Cycle time	Fa	Fr	N.	Service Condition
1/4	3kN	4kN	600 RPM	Light Shock
1/4	4kN	4kN	800 RPM	Light Shock
1/2	5kN	4kN	1000 RPM	Light Shock

3. a) A 7.5 kw, 1440 rpm electric motor is to drive the input shaft of a hammer mill at 600 rpm. Space is at premium level and one proposal is to use a shot centre flat belt drive with a centre distance equal to the diameter of the larger pulley. Design the flat belt drive (Design of larger pulley is not expected) **10**

b) A 960 rpm motor is to be used to drive an oil field pumping unit that requires 450 N.m torque at approximately 320 rpm. Assuming that a roller chain drive is to be used and there is a efficiency of 95 percent and service factor of 1.5. determine the following **10**

i) Motor Power
ii) No. of teeth on the sprockets
iii) pitch and number strands of chain
iv) pitch diameter; out side diameter and width of sprocket.

4. a) A 40 kw, 960 rpm A.C. split phase motor is to be used to drive a pump at speed of 300 rpm. The centre distance is to be approximately 1.2 meter. Determine the details of multiple V – Belt drive i.e. the pulley diameters, section and no. of V – Belt and width of pulley. **8**

b) Determine the size of special flexible 6 x 37 wire rope and the drum diameter required for an elevator in a building 125 m tall for a load of 24 kN. Assume a rope speed of 300 m/min and an acceleration of $2\,m/sec^2$, when starting with no slack. According to law not less than 4 ropes must be used. If there is a slack of 1 percent, what is the safety factor during starting. **12**

5. Figure (5) shown a two stage gear drive for rotary kiln driven by 9 kw 960 rpm electric motor. The kiln is required to be rotated at 60 rpm. The gears may be designed for a starting overload of 30%. The kiln has to operate 24 hours a day. Design gear drive for any one stage. The material for both the gear is SAE 1045 heat treated with $So = 245\,MPa$. The gear tooth profit is 20º full depth. Also design gear blank for longer gear. **20**

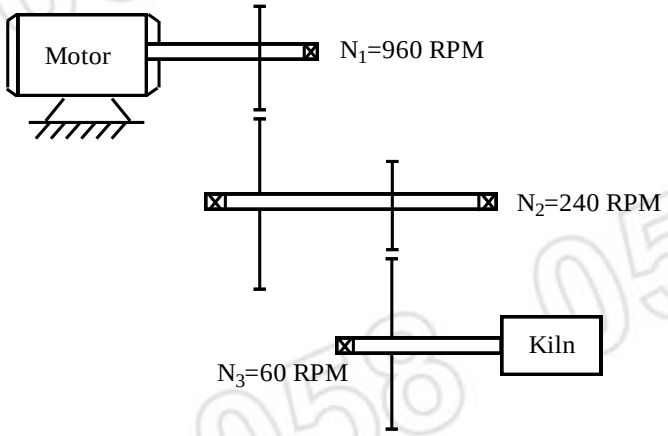

Fig. (5)

6. a) A pair of straight tooth bevel gears is to be used to transmit 16 kw for continuous duty. Determine the required module and suitable heat treatment. The shalt are inclined at 90 degree. **15**

Sr. No.	Description	pinion	gear
1	No. of teeth	21	60
2	Material	Steel	C.I.
3.	Basic Stress	210 MPa	105 MPa
4.	Speed RPM	1200	420
5.	Tooth Profit	20º F.D.	20º (full depth)

b) Define formative or virtual number of teeth on a helical gear. Derive the expression used to obtain it's value. **5**

7. a) Design a cylinder for a four stroke water cooled diesel engine developing 4 kw at 1500 RPM for the following assumption. **20**

i) The indicated mean effective pressure at the full load condition is $700\,kN/m^2$.

ii) Length of stroke = 1.1 times cylinder bore 'D'.

iii) Maximum explosion pressure = 8 time mean effective pressure

iv) $\alpha = 11\times10^{-6}\,mm/^{o}C$

v) $\Delta T = 120^{o}C$

8. In a construction hoist approximately 40 kN. load is to be lifted with velocity of 60 M/min. Diameter of rope drum is 500 mm. Power to the drum shaft is to be transmitted from 1200 rpm motor through worm gear drive. Determine **20**

i) Power to be transmitted

ii) Major dimensions of worm and worm gear

iii) The temperature rise of oil.

Assume that work gear is keyed to drum shalt & material for worm SAE 2320 steel & for gear the material is Phosper Bronze SAE 65.

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