

GUJARAT TECHNOLOGICAL UNIVERSITY
BE – SEMESTER–VIII • Remedial EXAMINATION – WINTER 2013

Subject Code: 181902**Date: 16/09/2013****Subject Name: Machine Design - II****Time: 03:00 pm – 05:30 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

Q.1 (a) Explain standard system of gear tooth and advantage and disadvantages of 14.5° and 20° involutes system. **04**

(b) Design a spur gear pair from the following given data. **10**

Power to be transmitted = 22.5 kW, Pinion speed = 1450 rpm, Speed reduction = 2.5, No. of teeth on pinion = 20, Service factor = 1.5, $b = 10m$, Pitch line velocity = 5 m/sec (For initial calculation of module), Maximum permissible error in gear tooth profile = 0.025 mm, $k = A$ factor depending upon the form of teeth = 0.111, Velocity factor = $3 / (3 + V)$, where V is the pitch line velocity in m/s.

Take endurance surface hardness = 600 MPa

Lewis form factor = $0.154 - 0.912 / \text{No. of teeth}$ for 20° pressure angle involute tooth system. The materials and stresses are as under:

Material	[σ_b]	Elasticity Modulus	Hardness
Pinion (Fe 410)	135 N/mm ²	2.1×10^5 N/mm ²	260 BHN
Gear (FG 200)	65 N/mm ²	1.1×10^5 N/mm ²	250 BHN

Q.2 (a) Explain the different causes of gear tooth failures and suggest possible remedies to avoid such failures. **04**

(b) Two shafts at right to each other are connected by a bevel pair having full depth involute teeth. The pinion having 20 teeth transmits 40 kW at 750 rpm to gear shaft running at 375 rpm. Take allowable static stress for pinion and gear materials 100 N/mm^2 and 70 N/mm^2 respectively. Determine module, pitch diameters and face width **10**

OR

(b) A pair of parallel helical gears consists of a 20 teeth pinion meshing with a 100 teeth gear. The pinion rotates at 720 rpm. The normal pressure angle is 20° , while the helix angle 25° . The face width is 40 mm and the normal module is 4 mm. The pinion as well as the gear are made of steel 40C8 having ultimate tensile strength of 600 N/mm^2 and heat treated to a surface hardness of 300 BHN. The service factor and the factor of safety are 1.5 and 2 respectively. Assume that the velocity factor accounts for the dynamic load and calculate the power transmitting capacity of gears **10**

Q.3 (a) Following data refer to a 4-stroke petrol engine: **10**

Brake power = 7.5 Kw, Indicated mean effective pressure = 0.45 N/mm^2 , Maximum explosion pressure = 3.2 N/mm^2 , Mechanical efficiency = 80%, Allowable stress for C.I. cylinder = 40 MPa, Allowable stress for Ni-steel bolt = 70 N/mm^2 , Find: 1) Bore and Stroke of engine taking $L/D = 1.25$, 2) Thickness of cylinder wall and flange, 3) Size and number of bolts required to join the cylinder head.

(b) Why an I-section is usually preferred to round section in case of connecting rods? **04**

OR

Q.3 (a) Design a connecting rod for a high speed diesel engine from the following data: **10**
Cylinder bore = 100 mm, Stroke = 120 mm, Maximum speed = 1800 rpm, Compression ratio = 18, Max. Explosion pressure = 5 MPa, Mass of reciprocating parts = 3.5 Kg, Length of connecting rod = 240 mm, If the connecting rod is made of drop forged steel, determine the size of I-section, size of small end bearing, big end bearing and bolts. Assume suitable stresses.

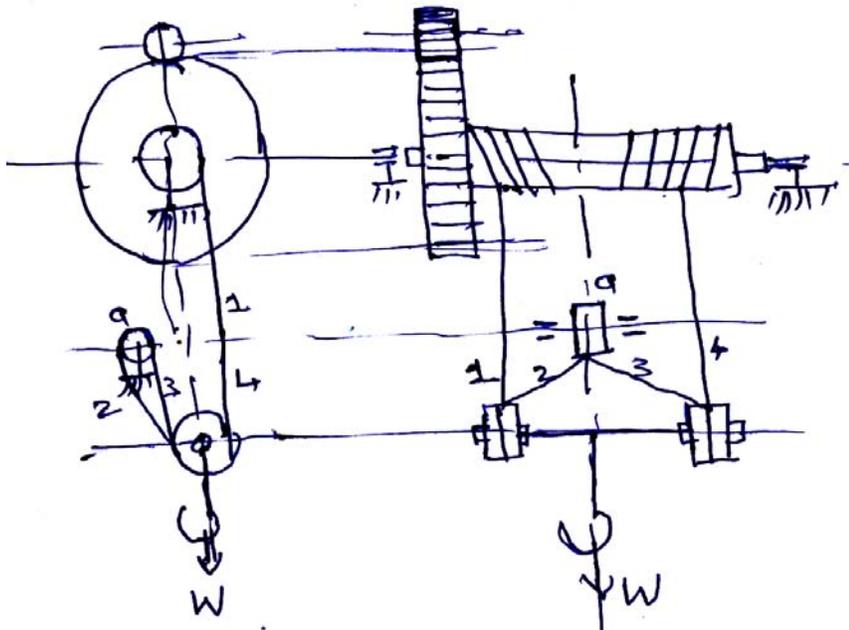
(b) What are the merits and demerits of wet and dry cylinder liners? **04**

Q.4 (a) Design a crane hook for lifting capacity of 5 tonnes. It is made from forged steel and has triangular section. Take permissible tensile stress 80 N/mm^2 . Use data design book to standardize the dimension of hook. **10**

(b) Classify the material handling equipments. **04**

OR

Q.4 (a) Select the ropes and drum for an over head travelling crane with a lifting magnet. **10**
Lifting capacity = 5000 kg (mass) Weight of lifting magnet = 200 kg (mass)
Weight of lifting tackle = 120 kg (mass)
Lifting height = 8 m No. of rope parts = 4



(b) Classify the belt conveyors **04**

Q.5 (a) Design a suitable speed gear box for a head stock of a lathe that has a variation of speed from 105 r.p.m. to 690 r.p.m. in 9 steps. The power is supplied by an electric motor of 10 KW capacity running at 1000 r.p.m. and having driving the input shaft through a V-belt drive having speed ratio of 2 : 1. Draw the structural diagram, speed chart and determine the number of teeth on each gears. **10**

(b) Differentiate between involute and cycloidal profile of the gears. **04**

OR

Q.5 (a) A triple threaded worm rotating at 1200 r.p.m. drives a worm gear having 36 teeth and transmits 15 KW power. The teeth are of 20° full depth involute profile. The axial pitch of the worm is 30 mm and pitch diameter of 60 mm. The co-efficient of friction is 0.03. Calculate 1) Helix angle of worm 2) Speed ratio 3) Centre distance between two shafts, 4) Apparent stress in the worm gear. 5) Efficiency of drive. **10**

(b) Give advantages and drawback of worm gear. **04**
