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(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 4088 Roll No.

B.Tech

(SEM V) ODD SEMESTER THEORY EXAMINATION 2009-10

DESIGN OF MACHINE ELEMENTS

Time : 3 Hours] *[Total Marks : 100*

Note : *(i) Attempt all questions.*
(ii) Assume any missing data suitably.
(iii) Use of design data book is permitted.

1 Attempt any **four** parts of the following : 5×4=20

(1) Write a biref note about the steps in process design.

(2) Briefly discuss about the different types of cast iron, and there IS designations.

(3) Discuss the effect of silicon, manganese, sulphur and phosphorous on cast iron.

(4) Explain briefly the bearing stress developed at the area of contact between two members.

(5) Write short notes on maximum shear stress theory and maximum strain energy theory.

(6) What is endurance strength of a material ? Briefly discuss the factors that affect the value of endurance limit of a material.

2 Attempt any **two** parts of the following : **10×2=20**

(a) In a spur gear dirve the diameter of pinion is 80 mm and the centre distance is 160 mm. The power to be transmitted is 9 kW at 1000 rpm of pinion. Using 20^{o} full depth teeth and material for pinion steel with permissible static bending stress of 220 MPa and for gear a steel with a permissible static bending stress of 180 MPa, determine the necessary module and width of the teeth using Lewis equation only.

(b) A bevel gear rotates at 600 rpm and transmits power to other gear rotating at 270 rpm. The outer module is 3.5 mm . The power transmitted is 35 kW. The teeth are 20^{o} involute full depth and L/B is 3. Check the safety of design if permissible stress is 55 MPa.

(c) Define the formative number of teeth on a helical gear. What is herringbone gear ? State its application. Also explain why helical gears are capable of transmitting greater power at high speed than spur gears.

Attempt any **two** parts of the following : **10×2=20**

(a) Design a cast iron protected type flange coupling to connect two shafts of 40 mm diameter transmitting 22 kW at 750 rpm. The overload capacity is 1.2 times the average torque. The bolts and keys are made of C20 steel and flanges are made of FG 200. Assume a factor of safety of 2.

(b) A 80 mm long journal bearing supports a load of 5 kN on a 80 mm diameter shaft. The bearing has a radial clearance of 0.05 mm and viscosity of oil is 0.02 kg/m-s at the operating temperature. If the bearing is capable of dissipating 90 J/s, determine the maximum safe speed of the shaft.

(c) A sluice gate weighing 800 kN is raised and lowered by means of two square threaded screws. The coefficient of friction between the thrust collar and the screw is 0.003 and that between the screw and nut is 0.05. Design the screw and nut.

4 Attempt any **one** parts of the following : **20×1=20**

(a) Design a piston of a four stroke diesel engine having following specifications :

Cylinder bore = 100 mm

Stroke = 125 mm

Speed = 1800 rpm

Maximum gas pressure = 5 N/mm^2

Indicated mean effective pressure = 0.55 N/mm^2

Mechanical efficiency = 80%

Fuel consumption = 0.15 kg per brake power per hour

Higher calorific value of fuel = 42000 kJ/kg

(b) Design a cast iron fly wheel for a four stroke IC engine developing 50 kW at 150 rpm with 75 explosions per minute. The total fluctuation of speed is limited to 0.5% of the mean on either side. The work done during the working stroke

is 1.4 times the work done during the cycle. Assume that the flywheel stores 16/15 times the energy stored by the rim and the rim section having width four times the depth so that the hoop stress does not exceed 4 N/mm^2. The density of the material is 7200 kg/cm^3.

5 Attempt any **one** of the following : **10×2=20**

(a) Design a valve spring of a petrol engine for the following operating conditions :

Spring load when valve is open = 500 N

Spring load when valve is closed = 250 N

Maximum inside diameter of the spring = 27 mm

Length of the spring when valve is open = 45 mm

Length of the spring when valve is closed = 55 mm

Maximum permissible shear stress = 450 MPa.

(b) Design a semi elliptical laminated vehicle spring to carry a load of 3 kN and consists of two full length leaves and five graduated leaves of width 65 mm. The spring is to be 1.1 m in length and attached to the axle by two U bolts 80 mm apart. These bolts hold the central portion of spring so rigidly that they may be considered equivalent to a band having a width equal to the distance between the bolt. The leaves have an allowable stress of 350 MPa. Take modulus of elasticity as 2.1×10^5 N/mm^2.