C. U. SHAH UNIVERSITY
Winter Examination-2019

Subject Name : Machine Design - II

Subject Code : 4TE07MDE1   **Branch: B.Tech (Mechanical)**

Semester : 7   **Date : 18/11/2019**   **Time : 10:30 To 01:30**   **Marks : 70**

Instructions:
  (1) Use of Programmable calculator & any other electronic instrument is prohibited.
  (2) Instructions written on main answer book are strictly to be obeyed.
  (3) Draw neat diagrams and figures (if necessary) at right places.
  (4) Assume suitable data if needed.

Q-1   **Attempt the following questions:**   **(14)**
  a) The interference in cycloidal tooth gears   **(1)**
         (a) depends upon pressure angle
         (b) depends upon number of teeth
         (c) is completely absent
         (d) is maximum
  b) The number of starts on worm for a velocity ratio of 40 is   **(1)**
         (a) single   (b) double   (c) triple   (d) quadruple
  c) Reducing pressure angle on gears results in   **(1)**
         (a) weaker teeth   (b) stronger teeth
         (c) high velocity ratio   (d) high efficiency
  d) According to Lewis equation   **(1)**
         (a) pinion is always weaker than gear
         (b) pinion is weaker than gear if made of same material
         (c) gear is weaker than pinion if made of same material
         (d) none of the above
  e) The main function of an automobile gearbox is   **(1)**
         (a) to reduce speed   (b) to increase speed
         (c) to provide variable speeds   (d) to increase power
  f) Cylinder thickness is calculated on the basis of,   **(1)**
         (a) radial stress   (b) residual stress
         (c) whipping stress   (d) circumferential hoop stress
  g) The function of piston skirt is   **(1)**
         (a) to provide bearing surface for side thrust
         (b) to support gas load
         (c) to support gudgeon pin
         (d) to seal the cylinder and prevent leakage of oil past piston
  h) Automotive crankshafts are made by,   **(1)**
         (a) casting process   (b) machining from rolled stock
         (c) drop forging process (d) welding process

i) The valve lift depends upon **(1)**
(a) bore and length of cylinder
(b) length of connecting rod and crank radius
(c) seat angle and diameter of port
(d) length of stroke and length of piston

j) The material commonly used for crane hooks is **(1)**
(a) cast iron   (b) wrought iron
(c) mild steel   (d) aluminum

k) Unit Size principle deals with **(1)**
(a) Select Light weight Material (b) provide Good Housekeeping
(c) select a versatile equipment (d) Increase quantity size weight of loads

l) Which of the following is not expressed by primary design equation? **(1)**
(a) Functional parameter   (b) Material parameters
(c) Geometrical parameters   (d) None of the above

m) Which of the following statements is false for troughed belt conveyors? **(1)**
1. Troughed belt conveyors use flexible belts
2. They contain five idlers
3. Depth of trough decreases with increasing number of idlers
4. Flexibility of belt increases as depth of trough decreases
(a) 1 and 2   (b) 2 and 3   (c)3 and 4   (d) None of the above

n) An essential requirement of a good MH system is **(1)**
(a) Storing Materials utilizing minimum space
(b) Flexibility reduction
(c)Sale ability of Plant & equipment
(d) Capital cost expenditure

Attempt any four questions from Q-2 to Q-8

Q-2   **Attempt all questions**   **(14)**
(a) Explain different modes of gear teeth failures, stating their reasons and remedies. **(04)**

(b) Design a suitable speed gearbox for a headstock of a lathe that has a variation of speed from 105 rpm to 690 rpm in 9 steps. If the gearbox is driven by 10 kW, 1000 rpm electric motor and the input shaft through v-belt drive, having speed reduction of 2:1 .Draw the structural diagram, Speed chart and determine the number of teeth on each gear. **(10)**

Q-3   **Attempt all questions**   **(14)**
(a) What do you understand by contact ratio? How it can be increased? What is its effect on gear strength? **(04)**

(b) The following particulars refers to a spur gear pair   **(10)**

Particulars	Pinion	Gear
Material	C-50 Steel	C-35 Mn 75 Steel
Ultimate Strength	700 MPa	600 MPa
BHN	240	225
Pitch Diameter	48 mm	144 mm
No.of Teeth	24	72 (20° Full Depth)
RPM	1440	480

Factor of safety =6, Service Factor (Ks)=1.5
Lewis form factor : $y = 0.154 - (0.912/Z)$
Velocity Factor (Kv)= $3/(3+V)$
Dynamic Factor (C) =230 N/mm
Wear factor(K)=0.156 $[BHN/100]^2$ N/mm^2
Specify the kW Capacity of the gear unit.

Q-4   **Attempt all questions**   **(14)**

(a) How the worm gear drive designated? Explain. Give advantages and drawback of worm gear.   **(04)**

(b) A Pair of helical gears having a transmission ratio 8:3 with a steady load condition, used for turbine. The maximum speed is 2400 r.p.m. the pinion is to have 27 teeth and face width 100 mm. The circular module is 6 mm. The material used for gears is heat treated steel with 250 BHN and have static stress of 210 MPa.The gears are carefully cut. Calculate 1.Power transmission capacity 2.Value of dynamic load and wear load   **(10)**
Take Service Factor (Ks)=1
Lewis form factor : $y = 0.154 - (0.912/$ No.of teeth)
Velocity Factor (Kv)= $5.6/ (5.6+\sqrt{v})$
Dynamic Factor (C) =349.65 N/mm
Wear factor(K)=0.156 $[BHN/100]^2$ N/mm^2

Q-5   **Attempt all questions**   **(14)**

(a) Sketch a valve gear mechanism of an internal combustion engine and label its various parts.   **(04)**

(b) Design a cast iron piston for a single acting four stroke engine for the following data: Cylinder bore=100 mm; Stroke=125 mm; Maximum explosion pressure=2.5 MPa ;Power developed = 80 kW; Fuel consumption=180 gm/kwh; Higher calorific value of fuel=45×10^3 kJ/kg; Speed = 2500 rpm; Allowable stress for C.I. Piston=40 MPa; Allowable bearing pressure for piston pin of steel=120 MPa; Allowable bearing pressure for small end of bearing=25 MPa; Take three compression rings and one scrapper ring, Take Thermal Conductivity $K = 175$ w/ $m^{2\,0}$c. m and $[Tc-Te] = 55^0 C$ for aluminium alloy. Any other data required for the design may be assumed.   **(10)**

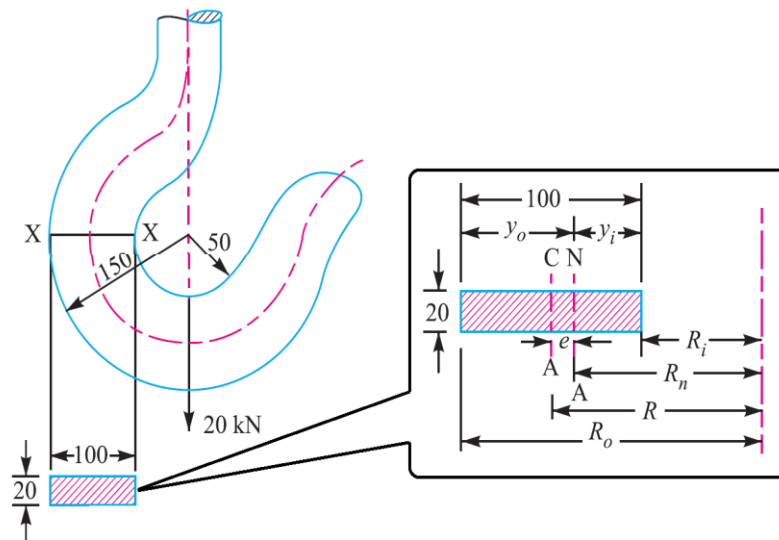**Q-6**   **Attempt all questions**   **(14)**

(a) Differentiate between adequate design & optimum design   **(04)**

(b) The cylinder of a four stroke petrol engine has the following specifications: Brake power = 7.5 kW; Speed = 1500 rpm; Maximum gas pressure = 3.2 MPa; Indicated mean effective pressure = 0.45 MPa; Mechanical efficiency =80%;Allowable stress for C.I. Cylinder=40 MPa, Allowable stress for Bolt=70 MPa, Reboring factor (k)=3.5 mm Calculate: **(10)**

1. Bore and stroke of the engine taking L/D=1.25
2. Thickness of the cylinder wall and flange
3. Thickness of the cylinder head
4. Size and number of bolts required to join the cylinder head

Q-7   Attempt all questions **(14)**

(a)   What are the basic objectives of a material handling system? **(04)**

(b)   The crane hook carries a load of 20 kN as shown in given below Fig. The section at X-X is rectangular whose horizontal side is 100 mm. Find the stresses in the inner and outer fibres, the given section. **(10)**

Use standard formulas :

Radius of curvature of Centroidal axis	$R = R_i + \dfrac{h}{2}$
Radius of curvature of the neutral axis	$R_n = \dfrac{h}{\log_e\left(\dfrac{R_o}{R_i}\right)}$

Q-8   Attempt all questions **(14)**

(a)   Explain different steps in optimum design using Johnsons Method with suitable example. **(07)**

(b)   Explain different conveyor belt take ups systems with neat sketch. **(07)**