

C. U. SHAH UNIVERSITY

Summer Examination- 2022

Subject Name: Machine Design-II

Subject Code: 4TE07MDE1

Branch: B.Tech (Mechanical)

Semester: 7

Date: 25/04/2022

Time: 02:30 To 05:30

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) A spur gear with pitch circle diameter D has number of teeth T . The module m is defined as
(a) $m = d / T$ (b) $m = T / D$ (c) $m = \pi D / T$ (d) $m = D . T$
- (b) In gear design contact ratio is always
(a) =1 (b) >1 (c) <1 (d) Can't be determined
- (c) Which of the following have stronger teeth?
(a) Stub teeth (b) Full depth teeth
(c) Both have equal strength (d) Can't be determined
- (d) The sum of the number of teeth on gear pairs for parallel shafts of the gearbox should be _____.
(a) same (b) varying (c) non-integer (d) odd number
- (e) Greater the velocity ratio, smaller the gearbox.
(a) True (b) Greater the gearbox
(c) Size of gearbox remains unaffected (d) None of the listed
- (f) The skirt of piston
(a) is used to withstand the pressure of gas in the cylinder
(b) acts as a bearing for the side thrust of the connecting rod
(c) is used to seal the cylinder in order to prevent leakage of the gas past the piston
(d) none of the above
- (g) The crankshaft in an internal combustion engine
(a) is a disc which reciprocates in a cylinder
(b) is used to retain the working fluid and to guide the piston
(c) converts reciprocating motion of the piston into rotary motion and vice versa
(d) none of the above
- (h) The length of the cylinder is usually taken as
(a) equal to the length of piston (b) equal to the length of stroke
(c) equal to the cylinder bore (d) 1.5 times the length of stroke
- (i) The material commonly used for crane hooks is
(a) cast iron (b) wrought iron (c) mild steel (d) aluminium



- (j) Which of the following material handling equipments is not suitable for moving materials in varying paths?
 (a) Hand trolley (b) Belt conveyor (c) Crane (d) Truck
- (k) Principle of 'Unit load' states that
 (a) materials should be moved in lots (b) one unit should be moved at a time
 (c) both 'a' and 'b' (d) none of the above
- (l) Johnsons Method is the method of
 (a) product design (b) compound design (c) optimum Design (d) system design
- (m) Ranges of certain parameters are expressed as:
 (a) cost, weight (b) stress equation (c) limit equation (d) shape, dimension
- (n) Optimum design is the process of selecting the best possible design satisfying certain criteria like
 (a) Feasible design (b) Geometrical tolerance
 (c) Dimensional tolerance (d) Concurrent engineering

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

Q-2

Attempt all questions

- (a) Give advantages and limitation of worm gear drives. Also explain, how worm gear drive is designated? (07)
- (b) Design a speed gear box for a head stock of a lathe to give speed variation from 100 to 1120 rpm in 8 steps. The power is supplied by an electric motor of 15 kW running at 1000 rpm, through a belt drive giving a speed reduction of 1.6:1. Draw the structural diagram, speed chart, and calculate the number of teeth on each gear. (07)

Q-3

Attempt all questions

- (a) What are the rules and guidelines for gear box layout? (07)
- (b) A pair of straight teeth spur gears is to transmit 20 kW when the pinion rotates at 300 r.p.m. The velocity ratio is 1: 3. The allowable static stresses for the pinion and gear materials are 120 MPa and 100 MPa respectively. The pinion has 15 teeth and its face width is 14 times the module. Determine: 1. module; 2. face width; and 3. pitch circle diameters of the pinion and the gear from the standpoint of strength only, taking into consideration the effect of the dynamic loading. (07)

The tooth form factor y can be taken as

$$y = 0.154 - \frac{0.912}{\text{No. of Teeth}}$$

and the velocity factor C_v as

$$C_v = \frac{3}{3 + v}$$

where v is expressed in m/s.

Q-4

Attempt all questions

- (a) Explain the design procedure connecting rod of an I.C. engine. (07)
- (b) A belt conveyor is to be designed to carry bulk material at the rate of 300×10^3 kg/hour (07)
 with the following details:
 Bulk density of the material = 800 kg/m^3
 Angle of surcharge of bulk material = 15°
 Belt speed = 10 km/hour
 Material factor for plies, $k_1 = 2.0$



Belt tension and arc of contact factor, $k_2 = 63$

No. of plies for the belt = 4.

Suggest: (a) suitable width for the belt, (b) Diameter and length of the drive pulley.

Q-5

Attempt all questions

- (a) Explain basic objectives of material handling equipment? (07)
- (b) Design a cast iron piston for a single acting four stroke engine for the following data: (07)
Cylinder bore= 100 mm; Stroke= 125 mm; Maximum gas pressure= 5 N/mm²; Indicated mean effective pressure= 0.75 N/mm²; Mechanical efficiency= 80%; Fuel consumption = 0.15 kg per brake power per hour; Higher calorific value of fuel= 42 × 10³ kJ/kg; Speed = 2000 r.p.m. Any other data required for the design may be assumed.

Q-6

Attempt all questions

- (a) For bevel gears, define the following : (07)
(i) Cone distance; (ii) Pitch angle; (iii) Face angle; (iv) Root angle; (v) Back cone distance; and (vi) Crown height.
- (b) Design tensile bar of the length L=200 mm to carry a tensile load of 5 kN for minimum cost, out the following materials: (07)

Material	Mass Density (kg/m ³)	Material Cost (Rs/N Weight)	Yield strength (MPa)
Steel	7500	16	130
Aluminium Alloy	3000	32	50
Titanium Alloy	4800	480	90
Magnesium Alloy	2100	32	20

Q-7

Attempt all questions

- (a) What is Optimum Design? Write down Objective and Application of Optimum Design. (07)
- (b) State the design procedure for crankshaft? (07)

Q-8

Attempt all questions

- (a) Explain the design procedure of Crane Hook. (07)
- (b) A pair of helical gears is to transmit 15 kW. The teeth are 20° stub in diametral plane and have a helix angle of 45°. The pinion runs at 10000 r.p.m. and has 80 mm pitch diameter. The gear has 320 mm pitch diameter. If the gears are made of cast steel having allowable static strength of 100 MPa; determine a suitable module and face width from static strength considerations and check the gears for wear, given $\sigma_{es} = 618$ MPa. (07)

