

C. U. SHAH UNIVERSITY

Summer Examination-2020

Subject Name: Machine Design-II

Subject Code: 4TE07MDE1

Branch: B.Tech (Mechanical)

Semester : 7

Date : 29/02/2020

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.
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Q-1

Attempt the following questions:

(14)

- (a) Greater the velocity ratio, smaller the gearbox.
(a) True (b) Greater the gearbox
(c) Size of gearbox remains unaffected (d) None of the listed
- (b) In gear design contact ratio is always
(a) =1 (b) >1 (c) <1 (d) Can't be determined
- (c) There are ____ standard systems for the shape of gear teeth.
(a) 1 (b) 2 (c) 3 (d) 4
- (d) Which of the following have stronger teeth?
(a) Stub teeth (b) Full depth teeth
(c) Both have equal strength (d) Can't be determined
- (e) Lewis equation is used to obtain ____ strength of bevel gears.
(a) Beam (b) Abrasive (c) Wear (d) Corrosive
- (f) There are ____ types of liners.
(a) 1 (b) 2 (c) 3 (d) 4
- (g) Lewis equation in spur gears is applied
(a) only to the pinion (b) only to the gear
(c) to stronger of the pinion or gear (d) to weaker of the pinion or gear
- (h) The cylinders are usually made of
(a) cast iron or cast steel (b) aluminium (c) stainless steel (d) copper
- (i) Johnson's method involves _____ design equations for Optimum Design.
(a) Primary design equation (b) Subsidiary design equation
(c) Limit Equation (d) All of these
- (j) 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
- (k) In designing a connecting rod, it is considered like _____ for buckling about X-axis.



- (a) both ends fixed
- (b) both ends hinged
- (c) one end fixed and the other end hinged
- (d) one end fixed and the other end free
- (l) 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
- (m) The material commonly used for crane hooks is
 - (a) cast iron (b) wrought iron (c) mild steel (d) aluminium
- (n) 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

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

Q-2

Attempt all questions

- (a) What are the rules and guidelines for gear box layout? (07)
- (b) Design a 90° straight bevel gear pair to transmit 7.5 kw from the motor running at 1440 rpm from the following data: (07)
 Speed Reduction ratio = 4:1, Pressure angle = 20° (full depth), No. of teeth on pinion = 18, static stress for C.I. gears = 55 MPa, Stress concentration factor = 1.1, Service load factor = 1.5. Find module, face width and pitch circle diameter of gears.

Q-3

Attempt all questions

- (a) Give advantages and limitation of worm gear drives. Also explain How worm gear drive is designated? (05)
- (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. (09)

Q-4

Attempt all questions

- (a) Explain the term "Whipping stress" in context with connecting rod. (07)
- (b) A belt conveyor is to be designed to carry bulk material at the rate of 300×10^3 kg/hour with the following details: (07)
 Bulk density of the material = 800 kg/m³
 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) What are the basic principles in selecting the type of material handling equipment? (06)



- (b) Design a cast iron piston for a single acting four stroke cycle diesel engine from the following data: (08)
- Cylinder bore = 100 mm, Stroke = 120 mm,
 Maximum explosion pressure = 4.5 MPa,
 Brake mean effective pressure = 0.66 MPa,
 Specific fuel consumption = 2.2796 kg/hr,
 Higher calorific value of fuel = 42×10^3 kJ/kg,
 Speed of engine = 2000 rpm.
 Allowable stress for C. I. piston = 35 MPa,
 Allowable bearing pressure for piston pin of steel = 120 MPa,
 Allowable bearing pressure for small end bearing = 25 MPa.
 Take three compression rings and one scrapper ring. Any other data required for the design may be assumed.

Q-6 Attempt all questions

- (a) Explain different modes of gear teeth failures. (07)
- (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) Explain the design procedure of Crank Hook. (07)
- (b) What is Optimum Design? Write down Objective and Application of Optimum Design. (07)

Q-8 Attempt all questions

- (a) Explain the design procedure of cylinder of an I.C. engine. (05)
- (b) A reciprocating compressor is to be connected to an electric motor with the help of spur gears. The approximate central distance between the shafts is 500 mm. The motor speed is 900 rpm and the compressor speed is 200 rpm. A torque of 5000 Nm is to be transmitted through the gear. Taking starting torque 25 % higher than the normal torque, determine the module, face width and p.c.d. of gears. Gears are of 20° stub teeth and accurately cut. The allowable stress for cast steel gears is 140 MPa and has hardness of 180 BHN. Check the gears for dynamic load and wear load. Take $\sigma_{es} = 434$ MPa. (09)

