

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VII (NEW) EXAMINATION – WINTER 2021****Subject Code:3171917****Date:13/12/2021****Subject Name:Design of Machine elements****Time:10:30 AM TO 01:30 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		Marks
Q.1	(a) Give the classification of gears.	03
	(b) Derive the equation for formative number of teeth for helical gears.	04
	(c) Explain different types of gear tooth failures, causes and their possible remedies.	07
Q.2	(a) What do you mean by coupling? Give its applications.	03
	(b) List diff. types of Rolling contact bearing. Also write advantages and disadvantages of Angular contact bearing.	04
	(c) 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 is 25°. The face width is 40 mm and the normal module is 4 mm. The pinion as well as the gear is made of steel 40C8 (Sut = 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.	07
	OR	
	(c) Write the design procedure of helical spring	07
Q.3	(a) Explain Muff coupling in brief.	03
	(b) Derive Petroff's equation for journal bearing.	04
	(c) The following data is given for a hydrostatic thrust bearing: Thrust load = 500 kN & Shaft speed = 720 rpm; Shaft dia. = 500 mm & Recess dia. = 300 mm; Film thickness = 0.15 mm & Viscosity of lubricant = 160 SUS; Sp. Gravity = 0.86 Calculate: (1) Supply pressure (2) Flow requirement (3) Power loss in pumping (4) Frictional power loss	07
	OR	
Q.3	(a) Define static & dynamic load carrying capacity of rolling-contact bearing.	03

- (b) Explain importance of material selection in worm and worm wheel design **04**
- (c) A rigid coupling is used to transmit 20 KW power at 720 rpm. There are four bolts and the pitch circle diameter of the bolts is 125 mm. The bolts are made of steel 45C8 ($S_{yt} = 380 \text{ N/mm}^2$) and the factor of safety is 3. Determine the diameter of the bolts. **07**
Assume that the bolts are finger tight in reamed and ground holes
- Q.4** (a) Explain series and parallel connection of the helical spring. **03**
- (b) Differentiate between Arithmetic, Geometric and Harmonic Progressions in case of design of gear box. **04**
- (c) Draw the ray and speed diagram for a nine speed gear box. State the necessary assumptions taken. **07**
- OR**
- Q.4** (a) Explain Autofrettage in detail. **03**
- (b) What do you mean by thin and thick cylinder explain with suitable practical example. **04**
- (c) A single-row deep groove ball bearing No. 6002 is subjected to an axial thrust of 1000 N and a radial load of 2200 N. Find the expected life that 50% of the bearings will complete under this condition. **07**
- Q.5** (a) Name the materials used for engine cylinder and engine piston. **03**
- (b) Explain the classification cranes using different standards. **04**
- (c) Write the detail design procedure of crane hook. **07**
- OR**
- Q.5** (a) List the basic objectives of material handling systems. **03**
- (b) Explain valve gear mechanism in IC Engine. **04**
- (c) The following data is given for the piston of a four-stroke diesel engine: **07**
Cylinder bore = 250 mm
Maximum gas pressure = 4 MPa
Bearing pressure at small end of connecting rod = 15 MPa
Length of piston pin in bush of small end = 0.45D
Ratio of inner to outer diameter of piston pin = 0.6
Mean diameter of piston boss = 1.4 x outer diameter of piston pin
Allowable bending stress for piston pin = 84 N/mm²
Calculate:
(i) outer diameter of the piston pin;
(ii) inner diameter of the piston pin;
(iii) mean diameter of the piston boss; and
(iv) check the design for bending stresses.
