MANIPAL INSTITUTE OF TECHNOLOGY MANIPAL (A constituent unit of MAHE, Manipal)

## X SEMESTER B.TECH. (AERONAUTICAL/AUTOMOBILE ENGINEERING) END SEMESTER EXAMINATIONS, NOV/DEC 2022

SUBJECT: DESIGN OF MACHINE ELEMENTS [AAE -3173]

## **REVISED CREDIT SYSTEM**

(26/11/2022)

Time: 3 Hours

## MAX. MARKS: 50

## Instructions to Candidates:

✤ Answer ALL the questions.

Missing data may be suitably assumed.

Q No	Question	Marks	CO attained	BT level
1A	Briefly elucidate the design procedure for a machine element stating the different steps.	3	1	1,2
1B	Briefly explain any 3 methods to reduce stress concentration in material	3	1	1,2
1C	With a neat sketch explain which failure theory is suitable depending on the material.	4	1	1,2
2A	A helical spring is to be designed for an operating load range of approximately 90 to 135 N. The deflection of the spring for the load range is 7.5 mm. Assume a spring index of 10, and spring is square and grounded ends. Consider G = 79.34 GPa and Maximum allowable Shear stress = 690 MPa. Design the spring.	6	2	3
2B	From the previous question data, calculate free length and pitch of the spring.	2	2	3

2C	For the spring designed from the previous question, draw the sketch showing the relevant dimensions of the spring.	2	2	3
3A	Design a pair of spur gears to transmit 20 kW from a shaft rotating at 1000 rpm to a parallel shaft which is to rotate at 310 rpm. Assume the number of pinion 31 and 20° full depth tooth form. The material for pinion is C40 steel (untreated) and for gear cast steel 0.2%C (untreated). The gear is subjected to medium shock and 8 – 10 hrs duty per day.	5	3	3
3B	For the data in the previous question, calculate the gear dimensions and the type of gear chosen.	3	3	3
3C	For the data from the previous question, calculate the tangential and the dynamic load on the gear tooth.	2	3	3
4A	Select a suitable ball bearing for the shaft of axial flow compressor having the following details. Radial load = $3560$ N, Axial load = $1675$ N, Speed of the shaft = $1440$ rpm, diameter = $65$ mm, bearing life = $70$ hrs/week for 6 years.	6	4	3
4B	State at least 4 disadvantages of Rolling element bearings.	2	4	2
4C	State any 4 differences between sliding contact and rolling contact bearings.	2	4	2
5A	Select a roller chain to transmit 30 kW from a 900 rpm rotor to a line shaft rotating about 200 rpm. Service conditions will be 10 hr/day with moderate shock load conditions.	4	5	3
5B	For the data in previous question calculate the optimum centre distance, chain length in pitches.	3	5	3
5C	For the data in previous question, calculate the actual centre distance and the pitch diameter of sprocket.	3	5	3