

Name:

Enrolment No:

Roll No.



UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester/ Supplementary Examination, December 2020

Course: Design of Machine Elements

Program: B.Tech. Mechatronics / ADE /Mechanical

Course Code: MECH3001/ IPEG325/ADEG225

Instructions:

Semester: Vth Sem

Time 04 hrs.

Max. Marks: 100

1. Use of Design Data Handbook is allowed during the examination.

2. Assume the suitable data and mention in solution at start.

3. Draw the necessary diagrams.

Note:

1. Read the instruction carefully before attempting.

2. This question paper has 2 Sections: **Section A and Section B.**

3. There are total 4 questions of Scan and upload type in **Section A /B .**

4. **Both the sections** consist of design problems related to machine components.

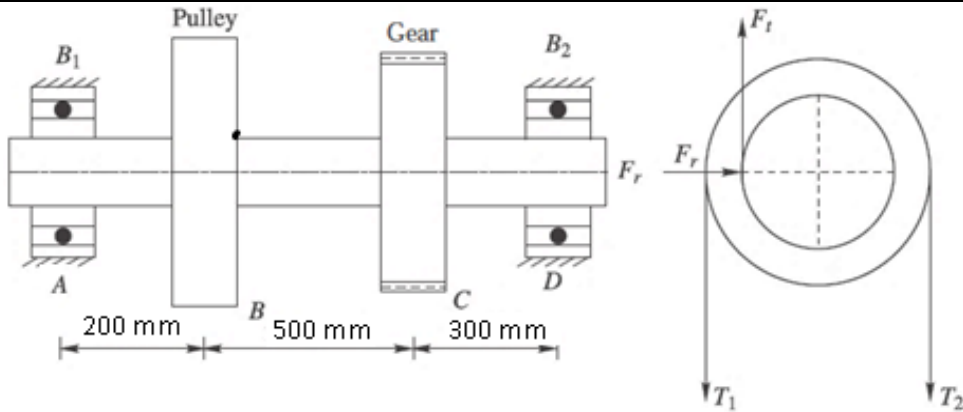
5. A is last 2 digit of your roll no.

6. **Examination** will be conducted online on CODETANTRA platform.

7. Write the answer over A4 sheet and mention clearly the page number at the top. After the completion of the Section A and B , scan and upload online through CODETANTRA platform.

Section – A (Attempt all the questions)

S. No.	Statement of question	Marks	CO
SECTION A			
Q 1	A shaft made of steel C40 is used to transmit (8+ 0.1 A) kW at 1440 rpm. A pulley mounted on the shaft has a diameter of 0.4 m and ratio of belt tensions is 3, as given in figure below. The teeth on gear of 250 mm pitch circle diameter has a 20° involute profile. Assume the equal torque on gear and pulley, design the shaft by using the ASME code. Draw the applicable force diagrams, Bending moment diagrams etc.	20	CO2/ CO4



Q 2 Design a riveted Joint in which the pitch of the rivets in the outer row is twice that in the inner rows. Diameter of boiler shell is $(1800 + 5A)$ mm and is subjected to internal pressure of 2.0 N/mm^2 . Consider the working stresses as $\sigma_t = 90 \text{ MPa}$ in tension, $\sigma_c = 135 \text{ MPa}$ in compression, and $\tau = 60 \text{ MPa}$ in shear for the joint.

OR

Determine the dimension of flange coupling that connect a motor and a pump shaft. The power to be transmitted is $(10 + A)$ kW at a shaft speed of 1000 rpm. Select suitable materials for the parts of the couplings and list the dimensions

20 CO3

Section B

Q 1 Design a pair of spur gear using the data given in the table below to transmit $(10 + 0.1A)$ kW of power available at pinion for speed reduction ratio of **4: 1**. Consider the speed of pinion as **1000 rpm**.

Detail	Pinion	Gear
Material	Steel C40 Untreated	Steel C40 Untreated
Design Stress	207 MPa	233.4Mpa
BHN	150	200
Tooth Profile	20° Involute	20° Involute

Assume the centre distance and design the gear from static and dynamic point of view. Suggest the BHN for designed gear. **Also make your conclusions.**

30 CO4

Q 2 (a) Suggest the rolling contact bearing (Deep groove ball bearing/ Angular contact bearing) for the following loading conditions;

Axial force = $(5000 + 10A)$ N

Radial force = $(4000 + 10A)$ N

Speed = 1500 rpm

Expected Life = 5 years

Assume the uniform and steady load. Write the other assumptions clearly. Suggest the shaft diameter.

15 CO2/C04

(b) Design the journal bearing for journal diameter in range of 80 mm to 120 mm used for **centrifugal pump application**. Load applied to bearing is **(15+0.1A)** kN and its speed is 900 rpm. Complete the design calculation for bearing. Mention clearly the data assumed in solution; journal diameter, lubricating oil and operating temperature oil etc. Make the conclusions.

15

CO2/C
04

Fig : Viscosity Vs Temperature Diagram for Lubricating Oils (Journal Bearing)
Q.No.2 (b)

