

Name:  
Enrolment No:



UPES

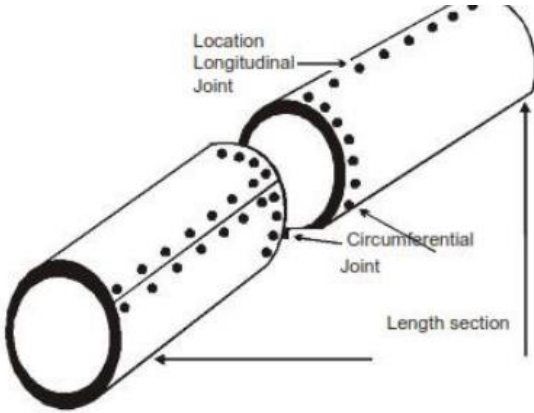
End Semester Examination, December 2023

Course: Principles of Engineering Design  
Program: B.Tech in Fire Safety Engineering  
Course Code: HSFS 3002

Semester: V  
Time : 03 hrs  
Max. Marks: 100

Instructions: 1. Use pencil and scale to draw neat sketches wherever required.  
2. Do step-by-step detailed calculations while solving the numerical.

SECTION A  
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Very short answer type questions:		
a)	What do you understand by the term creep?	2	CO 1
b)	Factor of safety?	2	CO 1
Q 2	<p>i. Differentiate lap joints with butt joints.</p> <p>ii. Referring to the following figure, suggest which type of joint will be preferred to use for circumferential joint and for longitudinal joint.</p> 	2+2	CO 5

Q 3	If springs in parallel are subjected to a force, how is that force distributed?	4	CO 2
Q 4	Discuss the various important parameters necessary for the selection of a particular drive for power transmission.	4	CO 3
Q 5	A pinion gear with 22 teeth has a rotational speed of 1200 rpm and drives a gear at 660 rpm. Determine the number of teeth on the gear. Also calculate angular speed of the gear.	3+1	CO 5
SECTION B (4Qx10M= 40 Marks)			
Q 6	<p>The gear train shown in the figure consists of gears A, B, C, D, E and F. All the gears are mounted on parallel shaft and the number of teeth of A, B, C, D, E and F are 20, 65, 26,65,30 and 65, respectively. Gear A is rotating at 450 rpm.</p> <p>a. Let's assume gear A is rotating in a clockwise direction, find out the direction of gear D &amp; gear F.</p> <p>b. Calculate the speed of gear B &amp; gear D.</p>	4+6	CO 3
Q 7	<p>Due to increasing demand for high-speed public transport, particularly on the railways, the requirements for more precise rail-track performance became a necessity. This led to the introduction of longer rails and continuously welded tracks. Problems associated with track expansion were overcome by using sleepers at shorter spacings and clamping the rail to them. This causes compression stresses in the rails, but does not allow expansion.</p> <p>During routine inspection of the rails it was discovered that uneven wear occurred and this was especially the case where the track was curved. The worn lengths had to be replaced, not necessarily with the full length of track. The procedure adopted involved flame-cutting the section out, replacing the section and then welding back together. Railtrack have identified a problem with these welds because they fatigue and crack after a short period of time. This is due mainly to the poor control of the cutting operation and not due to poor weld quality. Therefore, a portable 'Rail-Cutter' is required which could be used on site and track locations and be capable of cutting any rail section to such a high standard that no further attention of the rail ends is required. Produce a detailed specification for such a 'Rail-Cutter', broken down into functions and constraints.</p>	10	CO 3

Q 8	<p>A rigid bar weighing 12 KN and carrying a load of 20 KN is supported by 3 springs as shown in Figure, having spring constants <math>S_1 = 30 \text{ KN/m}</math>, <math>S_2 = 18 \text{ KN/m}</math> and <math>S_3 = 12 \text{ KN/m}</math>. If the unloaded springs are all the same length, find the distance 'X' such that the bar is horizontal.</p>	10	CO 5
Q 9	<p>Within a large catering organization many slices of bread are buttered. This is a tedious and time-consuming task. Generate two concepts for automating the process of applying the butter to the bread.</p>	10	CO 2
<p>SECTION-C (2Qx20M=40 Marks)</p>			
Q 10	<p>Blind people have difficulty in filling receptacles with hot liquids to the required level. Problem areas are the water level in a pan when cooking, liquid levels in a cup and the level of water in a bath. Generate as many concepts as possible for a simple hand-held device which will indicate to the person the level of liquid in all these cases.</p>	20	CO4
Q11	<p>An exhaust fan fitted with 900 mm diameter pulley is driven by a flat belt from a 30 kW, 950 r.p.m. squirrel cage motor. The pulley on the motor shaft is 250 mm in diameter and the centre distance between the fan and motor is 2.25 m. The belt is 100 mm wide with a coefficient of friction of 0.25. If the allowable stress in the belt material is not to exceed 2 MPa, determine total length of the flat belt.</p>	20	CO5