UPES
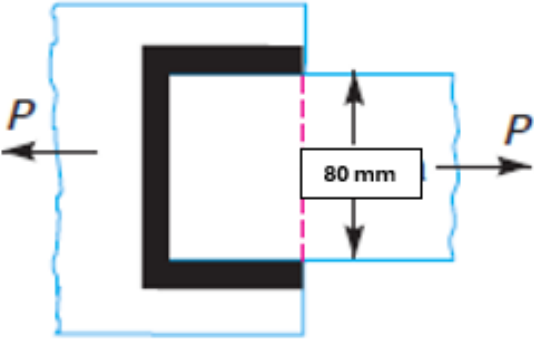**End Semester Examination, May 2025**

Course: **Principles of Engineering Design**   Semester: **IV**
Program: **B.Tech. Fire and Safety Engineering**   Time   : **03 hrs.**
Course Code: **HSFS2025**   Max. Marks: **100**

Instructions: Read the question paper properly and provide the most relevant answer

	SECTION A (5Qx4M=20Marks)		
S. No.		Marks	CO
Q 1	Explain the following: a) adaptive design, b) development design	4	CO2
Q 2	Discuss the concept of factor of safety	4	CO1
Q 3	Differentiate creep and Fatigue	4	CO4
Q 4	Define spring index	4	CO1
Q 5	Difference between piping and pipeline with an example	4	CO4
	SECTION B (4Qx10M= 40 Marks)		

Q 6	Two springs, Spring A and Spring B , have spring constants kA=200N/m and kB=300N/m, respectively.
	    a) If the two springs are connected in series , calculate the equivalent spring constant ($k$eq) of the system.
	    b) If the two springs are connected in parallel , calculate the equivalent spring constant ($k$eq) of the system.
		10	CO3

Q 7	Explain the total life cycle of the product in design process with possible sketch and also list its limitations	10	CO2
Q 8	A line shaft rotating at 300 r.p.m. is required to transmit 25 kW of power. The shaft is made of mild steel, and the allowable shear stress is 45 MPa. Determine the required diameter of the shaft, assuming there is no bending moment acting on it.	10	CO3
Q 9	With the neat sketch classify the different forms of threads in detail **(OR)** Determine the length of the weld run for a plate of size 80mm wide and 10 mm thick to be welded to another plate by means of single transverse weld and double parallel fillet weld. the maximum tensile stress and maximum shear stress are 50 MPa and 30MPa respectively. Find the length of each	10	CO3

	parallel fillet weld if the joint is subjected to static loading and fatigue loading.		
	SECTION-C **(2Qx20M=40 Marks)**		

Q 10	A compression coil spring made of high carbon steel used in fire fighting vehicle has the following specifications:
	   • Mean diameter of coil = 60 mm
	   • Wire diameter = 6 mm
	   • Number of active coils = 22
	If the spring is subjected to an axial load of 600 N, calculate the maximum shear stress in the spring material
		20	**CO4**

Q 11	a) Evaluate how the principles of engineering design can be applied in the field of fire safety engineering. Support your answer with any 4 relevant examples **(OR)** b) List and explain the achievements of performance requirements of a design. c) Explain the classification of good design considerations	**20** **(10+10)** **20**	**CO2**