BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP2023)

CLASS: BTECH **SEMESTER : IV**
BRANCH: MECHANICAL **SESSION : SP2023**

SUBJECT: ME211 MACHINE DESIGN

TIME: 02 Hours **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

			CO	BL
Q.1(a)	Design a cotter joint required to withstand a load of 50 kN. The cotter joint is made up of material having following allowable stresses: Allowable stress in tension = 55 MPa Allowable shear stress = 40 MPa Allowable Crushing stress = 70 Mpa	[5]	CO1	L2
Q.2(a)	A rotating shaft, subjected to a nonrotating force of 5 kN and simply supported between two bearings A and E is shown in Fig. 1. The shaft is machined from plain carbon steel 30C8 (S_{ut} = 500 N/mm^2) and the expected reliability is 90%. The equivalent notch radius at the fillet section can be taken as 3 mm. What is the life of the shaft? (Take s_e' = 0.5 S_{ut} , K_a = 0.79, K_b = 0.85, K_c = 0.897, K_t = 1.72)	[5]	CO1	L2

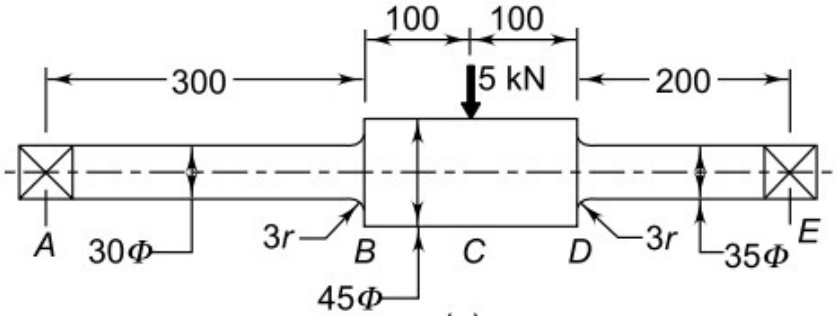

Fig. 1

Q.3(a)	What is standardization and what are the different standards used in mechanical engineering design?	[2]	CO1	L1
Q.3(b)	What are the methods of reducing stress concentration?	[3]	CO1	L1
Q.4(a)	A steel plate, 80 mm wide and 10 mm thick, is joined to another steel plate by means of a single transverse and double parallel fillet welds, as shown in Fig. 2. The strength of the welded joint should be equal to the strength of the plates to be joined. The permissible tensile and shear stresses for the weld material and the plates are 100 and 70 N/mm^2 respectively. Find the length of each parallel fillet weld. Assume that the tensile force passes through the centre of gravity of three welds.	[5]	CO2	L2

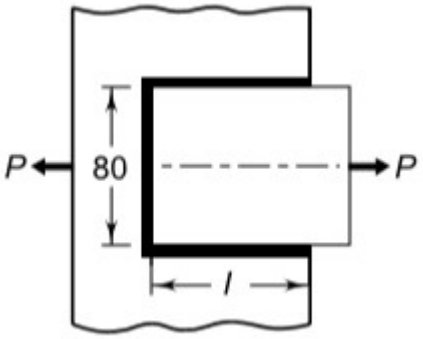

Fig. 2

PTO

Q.5(a) A cylindrical pressure vessel with a 1.5 m inside diameter is subjected to internal steam pressure of 1.5 MPa. It is made from steel plate by triple-riveted double-strap longitudinal butt joint with equal straps. The pitch of the rivets in the outer row is twice of the pitch of the rivets in the inner rows. The rivets are arranged in a zigzag pattern. The efficiency of the riveted joint should be at least 80%. The permissible stresses for the plate and rivets in tension, shear and compression are 80, 60 and 120 N/mm^2 respectively. Assume that the rivet in double shear is 1.875 times stronger than in single shear. Design the joint. [5] CO2 L2

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