BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: B.Tech **SEMESTER : 7th**
BRANCH: Mechanical Engg **SESSION : MO/2023**

SUBJECT: ME211 – MACHINE DESIGN

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Enumerate the theories of failures, Explain Distortion Energy theory or Von Mises theory with suitable example.	[5]	1	2
Q.1(b)	How the stress concentration can be reduced in a component having abrupt change of cross section? Explain Soderberg and Goodman lines, also show the equation of Goodman line is given by $\sigma_m / S_{ut} + \sigma_a / S_e = 1$	[5]	3	3
Q.2(a)	A steel plate,100 mm wide and 10 mm thick is joined with another steel plate by means of single transverse and double parallel fillet welds, as shown in the figure 1. 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 add the plates are 70 and 50 N/mm^2 respectively. Find the length of each parallel fillet weld, Assume the tensile force acting on the plates as static.	[5]	3	4

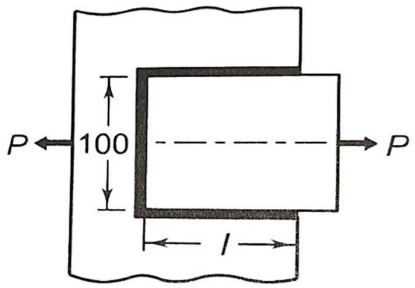

Figure 1.

Q.2(b)	Design a double riveted lap joint (Refer Figure 2.) for joining two plates of 10 mm thickness. The allowable stresses are 60 N/mm^2 in tension, 50 N/ mm^2 in shearing and 80 N/ mm^2 in crushing, Determine the efficiency of the joint. Assume other data suitably.	[5]	3	2

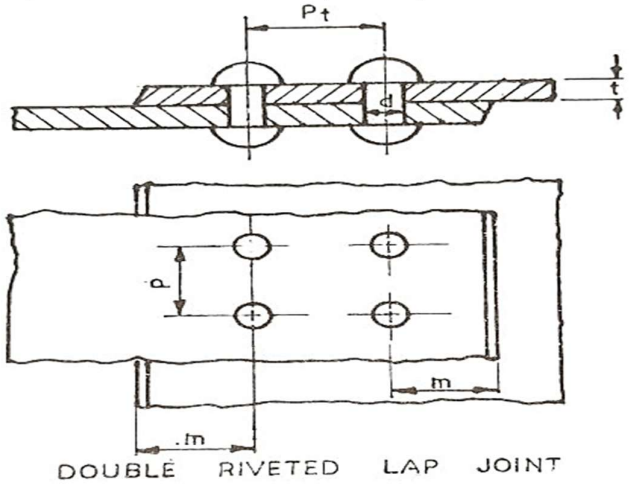

Figure 2.

PTO

Q.3(a)	For the Differential band brake prove that the expression for the pull P in anti-clockwise rotation of the drum is given by $$P = \frac{T_b\, b}{R\,(e^{\mu\,\theta} - 1)\, a}$$ Where T_b = Braking Torque, a = Length of the lever from fulcrum, b = distance of first belt joint from fulcrum, μ = Coefficient of friction between belt and brake drum, ϴ = Angle of lap in radians & R = radius of the brake drum.	[5]	3	2
Q.3(b)	A single plate clutch is used to connect a machine shaft to a driver shaft at 600 rpm. The uniform pressure is 0.1 N/mm^2 and coefficient of friction is 0.3. The inner and outer radii of the disc are 55 and 110 mm. The inertia of machine is 1 Kgm^2. Find (a) Axial force required (b) power capacity (c) angular acceleration and (d) Energy dissipation.	[5]	4	2
Q.4(a)	What are the functions of different types of springs? Explain the design procedure for the design of a helical spring.	[5]	2	3
Q.4(b)	Design a helical compression spring subjected to a maximum force of 7.5 KN. The mean coil diameter is 150 mm. The spring rate is 75 N/mm. The spring is made of oil hardened and tempered steel wire with ultimate tensile strength of 1250 N/ mm^2, the permissible shear stress for the spring wire is 30 % of the ultimate tensile strength. Take G = 81370 N/mm^2. Calculate (i) Wire diameter and (ii) No. of active coils	[5]	3	5
Q.5(a)	Explain compound gear train and epicyclic gear train with neat sketches.	[5]	1	2
Q.5(b)	For a given pair of spur gears if the speed of the driving shaft is 1000 rpm and power transmitted is 3.5 KW, find the resultant force on the mating tooth. The pitch circle diameter of the gear is 200 mm and angle α between pressure line with tangent at pitch point is 20 degrees.	[5]	3	4

:::::29/11/2023 M:::::