

V- SEM MECH/M(MAIN)/M(PROD)/DIP.MECH/M (I.I)/2019(W)/ (New)

MET-501-MACHINE DESIGN

Full Marks: 80

Time: 3 Hours

Answer any Five Questions including Q No. 1 & 2

Figures in the right hand margin indicates marks

Use of Calculator and Data book is allowed

1.	Answer ALL the questions: (a) Define machine design and classify it. (b) What is the function of shaft and key? (c) What types of stresses are induced in shafts? (d) Define creep and fatigue. (e) What are the various types of pulleys used for flat belts? (f) What do you mean by factor of safety? (g) Define spring index and spring rate. (h) State the advantages of screwed joints. (i) What are the various modes of failure of riveted joints? (j) What do you understand by the single start and double start screw?	2x10
2.	Answer any SIX questions: (a) What are the advantages of welded joints over riveted joints? (b) Describe the general procedure followed in machine design. (c) Prove that the ratio of driving tensions on the two sides of a pulley is: $\frac{T_1}{T_2} = e^{\mu\theta}$ (d) An eye bolt is to be used for lifting a load of 60kN. Find the nominal diameter of the bolt, if the tensile stress is not to exceed 100MPa. <a href="http://www.sctevtonline.com">http://www.sctevtonline.com</a> (e) Find the diameter of a solid steel shaft to transmit 20kW at 200 r.p.m. The ultimate shear stress for the steel may be taken as 360MPa and a factor of safety as 8. If a hollow shaft is to be used in place of the solid shaft, find the inside and outside diameter when the ratio of inside to outside diameters is 0.5. (f) State the factors governing the design of machine elements. (g) Design the rectangular key for a shaft of 50mm diameter. The shearing and crushing stresses for the key material are 85MPa and 170MPa.	5x6
3.	Design a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5m in diameter subjected to a steam pressure of 0.95N/mm <sup>2</sup> . Assume joint efficiency as 75%, allowable tensile stress 90MPa, compressive stress 140MPa and shear stress 56MPa.	10
4.	What are the assumptions made in the design of welded joints? A plate 100mm wide and 12.5mm thick is to be welded to another plate by means of parallel fillet welds. The plates are subjected to a load of 50kN. Find the length of the weld so that the maximum stress does not exceed 56MPa. Consider the joint under static loading and fatigue loading.	10
5.	Design a rubber belt to drive a dynamo generating 20kW at 2250r.p.m and fitted with a pulley of 200mm diameter. Assume dynamo efficiency to be 85% and belt thickness 1mm. Allowable stress for belt = 2.1MPa Density of rubber = 1000kg/m <sup>3</sup> Angle of contact for dynamo pulley = 165° Coefficient of friction between belt and pulley = 0.3	10

	<p>6. Design a helical compression spring for a maximum load of 1000N for a deflection of 25mm using spring index as 5. The maximum permissible shear stress for spring wire is 420MPa and modulus of rigidity is 84kN/mm<sup>2</sup>.</p> <p>Take Wahl's factor, <math>K = \frac{4C-1}{4C-4} + \frac{0.615}{C}</math></p> <p>7. Write short notes:</p> <p>(i) Assumptions in designing boiler joints</p> <p>(ii) Effect of Keyway</p> <p>(iii) Surge in spring</p> <p>(iv) Caulking and Fullering</p>	<p>10</p> <p>2.5x4</p>
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