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| **Model Question Paper-1 with effect from 2019-20 (CBCS Scheme)** | | | | | | |
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| **Fifth Semester B.E. Degree Examination**  **Design of Machine Elements - I** | | | | | | |
| **TIME: 03 Hours** | | |  | **Max. Marks: 100** | | |
| Note: | 1. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**. 2. Missing data if any must be assumed suitably. | | | | | |

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| **Module – 1** | | |  |
| **Q.1** | **(a)** | With flow diagram, Explain phases of design. | **05 Marks** |
| **(b)** | List and explain the factors to be considered for selection of material for a machine component | **05 Marks** |
| **(c)** | A 1mm thick Steel hacksaw Blade is bent into a circular arc of radius 500 mm. Determine the bending moment applied and the self-induced. The stress induced in the is 15mm. Modulus of elasticity 200 GPa. | **10 Marks** |
| **OR** | | |  |
| **Q.2** | **(a)** | What is stress concentration explain with neat sketches any three methods to reduce stress concentration in machine elements | **10 Marks** |
| **(b)** | A round rod of 60mm diameter is subjected to bending moment of 900 N-m and a twisting moment of 1200 N-m. Determine the maximum normal and shear stresses induced in the rod. | **10 Marks** |
| **Module – 2** | | |  |
| **Q.3** | **(a)** | Derive an expression for impact strength in the axial bar of cross section ‘A’ and length ‘l’ due to an impact load ‘W’ falling from a height ‘h’ on the bar | **10 Marks** |
| **(b)** | A cantilever beam of rectangular cross section has a span of 800mm, the rectangular cross section of the beam has a depth of 200mm the free end of the beam is subjected to a transverse load that fluctuates between 8kN down to 5kN up. The material for the beam is steel with an yi was off to 94 mph entrance strength of 275 MP and factor of safety is 2.5 determine the width of the rectangular protection taking surface finish factor as 0.95 size factor as zero point 90 and stress concentration factor 1.65 | **10 Marks** |
| **OR** | | |  |
| **Q.4** | **(a)** | Derive the Goodman equation for designing the member subjected to fatigue loading | **10 Marks** |
| **(b)** | A hot rolled steel shaft is subjected to a torsional load varying from 330 N-m clockwise to 110 N-m counterclockwise and an applied bending moment varies from + 440 N-m to -220 N-m. Determine the required shaft diameter. The ultimate strength of the material is 550 MPa and yield stress is 410 MPa, factor of safety as 1.5, endurance limit as half the ultimate strength and the size factor as 0.85. Neglect the effect of stress concentration. | **10 Marks** |
| **Module – 3** | | |  |
| **Q.5** |  | A steel shaft C45 transmitting 15kw at 210 rpm is supported between two bearings mounted 1000 mm apart. On this two spur gears are mounted the gear having a teeth of module 6 mm is located 100 mm to the left of the right bearing and receive power from a driving gear such that the tangential force acts vertical the pinion having 24 teeth and 6 mm module located 200mm to the right of the left bearing and delivers power to a gear mounted behind it. Taking combined shock and fatigue factor 1.75 in bending and 1.25 in torsion and determine the diameter of the shaft | **20 Marks** |

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| **OR** | | |  |
| **Q.6** | **(a)** | Design a socket and spigot type cotter joint to sustain an axial load of 100 kN. The material selected for the joint has the following design stresses 80 MPa in tension, 60 MPa in shear and 150 MPa in compression. | **10 Marks** |
| **(b)** | A cast iron flange coupling is used to connect two shafts of 80 mm diameter. The shafts run at 250 RPM and transmit a torque of 4300 N-m and the permissible shear stress for bolt material is 50 MPa and permissible shear stress for flange is 8MPa. Design bolts and the coupling. | **10 Marks** |
| **Module – 4** | | |  |
| **Q.7** | **(a)** | Explain in brief the failures of riveted joints. | **10 Marks** |
| **(b)** | Design a double riveted butt joint with equal width cover plates to join two plates of thickness 10mm. The allowable stress for plate and rivets are 80 MPa in tension, 60 MPa in shear and 120 MPa in crushing. | **10 Marks** |
| **OR** | | |  |
| **Q.8** | **(a)** | Steel plate is welded by fillet weld to structure and is loaded as shown in figure 8 a. Calculate the size of the weld if the load is 35 kN and allowable shear stress for the weld material is 90 MPa. | **10 Marks** |
| **(b)** | A circular beam 50 mm in diameter is welded to a support by means of a fillet weld as shown in figure 8 (b). Determine the size of weld, if the permissible shear stress in the weld is limited to 100 Mpa. | **10 Marks** |
| **Module – 5** | | |  |
| **Q.9** | **(a)** | Explain the stresses induced in screw fastening subjected to static and impact loading | **10 Marks** |
| **(b)** | A cylinder head of a steam engine is subjected to a steam pressure of 0.8 MPa. It is held in position by means of 12 bolts. A soft copper gasket is used to make the joint leak proof. The bore diameter of the cylinder is 250 mm. Find the size of bolts so that the stress in the bolt is not exceed 110 MPa. | **10 Marks** |
| **OR** | | |  |
| **Q.10** | **(a)** | Derive an expression for torque required to lift the load on a square threaded screw. | **10 Marks** |
| **(b)** | A square threaded power screw has a nominal diameter of 30 mm and a pitch 6mm with double start. Load on the screw is 6 kN and the mean diameter of the thrust collar is 40 mm. The coefficient of friction for the screw is 0.1 and for collar is 0.09. Determine  (i) Torque required to rotate the screw against the load.  (ii) Torque required to rotate the screw with the load.  (iii) Overall efficiency.  (iv)is the screw self locking? | **10 Marks** |

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| **Table showing the Bloom’s Taxonomy Level, Course Outcome and Programme Outcome** | | | | | | | |
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| **Question** | | | **Bloom’s Taxonomy Level attached** | | **Course Outcome** | **Programme Outcome** | |
| **Q.1** | (a) | | **L1** | | **CO 1** | **PO 1** | |
| (b) | | **L1** | | **CO 1** | **PO 1** | |
| (c) | | **L3** | | **CO 2** | **PO 2** | |
| **Q.2** | (a) | | **L2** | | **CO 1** | **PO 1** | |
| (b) | | **L3** | | **CO 2** | **PO 2** | |
| **Q.3** | (a) | | **L1** | | **CO 1** | **PO 1** | |
| (b) | | **L3** | | **CO 3** | **PO 2** | |
| **Q.4** | (a) | | **L1** | | **CO 1** | **PO 1** | |
| (b) | | **L3** | | **CO 3** | **PO 3** | |
| **Q.5** | (a) | | **L3** | | **CO 4** | **PO 4** | |
| **Q.6** | (a) | | **L3** | | **CO 3** | **PO 3** | |
| (b) | | **L3** | | **CO 3** | **PO 3** | |
| **Q.7** | (a) | | **L1** | | **CO 3** | **PO 1** | |
| (b) | | **L3** | | **CO 3** | **PO 3** | |
| **Q.8** | (a) | | **L3** | | **CO 4** | **PO 3** | |
| (b) | | **L3** | | **CO 4** | **PO 3** | |
| **Q.9** | (a) | | **L1** | | **CO 1** | **PO 1** | |
| (b) | | **L3** | | **CO 4** | **PO 3** | |
| **Q.10** | (a) | | **L1** | | **CO 1** | **PO 1** | |
| (b) | | **L3** | | **CO 4** | **PO 4** | |
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| **Bloom’s Taxonomy Levels** | | **Lower order thinking skills** | | | | | |
| Remembering(  knowledge):𝐿1 | | Understanding  Comprehension): 𝐿2 | | | Applying (Application):  𝐿3 |
| **Higher order thinking skills** | | | | | |
| Analyzing (Analysis): 𝐿4 | | Valuating (Evaluation): 𝐿5 | | | Creating (Synthesis): 𝐿6 |
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Related image