**Roll No:** | | | | | | | | | | | | |

# Sir Issac Newton College of Engineering and Technology-Nagapattinam

## MODEL EXAM

Fifth Semester

Mechanical Engineering

ME8593-DESIGN OF MACHINE ELEMENTS

Date: 01.12.2022 Session : FN

Time: 9.30 -12.30 AM Maximum: 100 marks

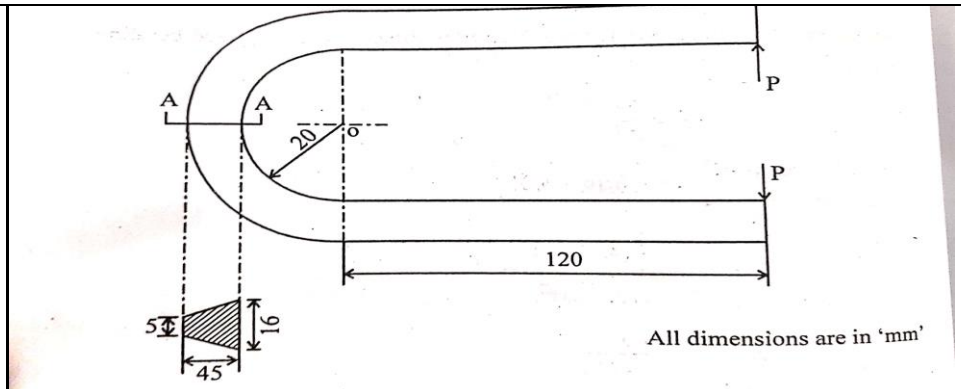
**Answer ALL Questions**

**PART - A (10X 2 = 20 marks)**

| Q.NO | Questions | Marks | CO | BL | PO |
|---|---|---|---|---|---|
| 1 | Define Endurance limit. | 2 | CO1 | L3 | 3 |
| 2 | What are the factors affecting endurance strength of a material | 2 | CO1 | L2 | 3 |
| 3 | How hollow shaft are superior to solid shaft? | 2 | CO2 | L2 | 3 |
| 4 | Is what situation flexible coupling are used? | 2 | CO2 | L4 | 3 |
| 5 | List the advantages and disadvantages of threaded fasteners. | 2 | CO3 | L2 | 3 |
| 6 | How is welding classified? | 2 | CO3 | L3 | 3 |
| 7 | Define Resilience of a spring. | 2 | CO4 | L5 | 3 |
| 8 | What is the function of a flywheel? | 2 | CO4 | L2 | 3 |
| 9 | State the merits of hydrostatic bearing | 2 | CO5 | L3 | 3 |
| 10 | What are the bearing materials? | 2 | CO5 | L2 | 3 |

**PART- B (5 X 13 = 65 marks)**

| Q.NO | Questions | Marks | CO | BL | PO |
|---|---|---|---|---|---|
| 11. | **(a)**. a frame of punch press is shown in figure. the frame is subjected to a load of 4.5kn as shown in figure. fine the stress at the inner fiber and outer fiber of the frame. | 13 | CO1 | L1 | 3 |

| | | | | | |
|---|---|---|---|---|---|
| |  | | | | |
| | **Or** | | | | |
| | **(b**). A cantilever beam of circular cross section is subjected to a cycle transverse load varying from –p to 3p as shown in figure. the theoretical stress concentration factor is 1.4, notch sensitivity is 0.9, endurance limit is 275 N/mm², size factor is 0.85 and surface finish factor is 0.89 .using the above said values, find the maximum load that can be withstand by this cantilever beam. assume σu=550N/mm², σy=470N/mm² and factor of safety=2 | 13 | CO1 | L3 | 3 |
| 12. | **(a).** A 15 kW, 960 r.p.m. motor has a mild steel shaft of 40 mm diameter and the extension being 75 mm. The permissible shear and crushing stresses for the mild steel key are 56 MPa and 112 MPa. Design the keyway in the motor shaft extension. Check the shear strength of the key against the normal strength of the shaft | 13 | CO2 | L2 | 3 |
| | **Or** | | | | |
| | **(b).** Design a clamp coupling to transmit 30 kW at 100 r.p.m. The allowable shear stress for the shaft and key is 40 MPa and the number of bolts connecting the two halves are six. The permissible tensile stress for the bolts is 70 MPa. The coefficient of friction between the muff and the shaft surface may be taken as 0.3 | 13 | CO2 | L3 | 3 |
| 13. | **(a)** Design a knuckle joint to transmit 150 kN. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression | 13 | CO3 | L2 | 3 |
| | **Or** | | | | |
| | **(b).** A plate 100 mm wide and 12.5 mm thick is to be welded to another plate by means of parallel fillet welds. The plates are subjected to a load of 50 kN. Find the length of the weld so that the maximum stress does not exceed 56 MPa. Consider the joint first under static loading and then under fatigue loading. | 13 | CO3 | L3 | 3 |
| 14. | **(a).** A helical spring is made from a wire of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is 350 MPa and modulus of rigidity 84 kN/mm2, find the axial load which the spring can carry and the deflection per active turn. | 13 | CO4 | L3 | 3 |

| | | | | | |
|---|---|---|---|---|---|
| | **Or** | | | | |
| | **(b).**. A shaft fitted with a flywheel rotates at 250 r.p.m. and drives a machine. The torque of machine varies in a cyclic inner over a period of 3 revolutions. The torque rises from 750 N-m to 3000 N-m uniformly during 1 / 2 revolution and remains constant for the following revolution. It then falls uniformly to 750 N-m during the next 1 / 2 revolution and remains constant for one revolution, the cycle being repeated thereafter. Determine the power required to drive the machine. If the total fluctuation of speed is not to exceed 3% of the mean speed, determine a suitable diameter and cross-section of the flywheel rim. The width of the rim is to be 4 times the thickness and the safe centrifugal stress is 6 MPa. The material density may be assumed as 7200 kg /m3 | 13 | CO4 | L2 | 3 |
| 15 | **(a).** Design a journal bearing for a centrifugal pump from the following data: load on the journal 2000N; speed of the journal=900r.p.m; Type of oil is SAE 10, for which absolute viscosity at 550C=0.017KG/M-S ambient temperature of oil =15.50°C; maximum bearing pressure of the pump=1.5 N/mm2 . Calculate also mass of the lubricating oil required for artificial cooling, if rise of temperature of oil be limited to 10°C. heat dissipation co efficient=1232 W/m2 /°C. | 13 | CO5 | L4 | 3 |
| | | | | | |
| | **(b).** A single row angular contact ball bearing number 310 is used for an axial flow compressor. The bearing is to carry a radial load of 2500 N and an axial or thrust load of 1500 N. Assuming light shock load, determine the rating life of the bearing. | 13 | CO5 | L4 | 3 |

**PART- C (1 X 15 = 15 marks)**

| Q.NO | Questions | Marks | CO | BL | PO |
|---|---|---|---|---|---|
| 16. | **(a).** Design a sleeve and cotter joint to resist a tensile load of 60 kN. All parts of the joint are made of the same material with the following allowable stresses : $\sigma t$ = 60 MPa ; $\tau$= 70MPa and $\sigma c$ = 125 MPa | 15 | CO1 | L3 | 3 |
| | **Or** | | | | |
| | **(b)** . Design a helical spring for a spring loaded safety valve (Rams bottom safety valve) for the following conditions. Diameter of valve seat = 65 mm ; Operating pressure = 0.7 N/mm2; Maximum pressure when the valve blows off freely = 0.75 N/mm2; Maximum lift of the valve when the pressure rises from 0.7 to 0.75 N/mm2 = 3.5 mm: Maximum allowable stress = 550 MPa ;Modulus of rigidity = 84 kN/mm2; Spring index = 6. | 15 | CO5 | L4 | 3 |

\

| BT LEVEL | | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | % |
|---|---|---|---|---|---|---|---|---|
| **Remember** | **Q. Nos** | 11(a), | | | | | | 7.22 |
| | **Marks** | 13 | | | | | | |
| **Understand** | **Q. Nos** | 2 | 3,12(a) | 5,13(a) | 8,14(b) | 10 | | 27.22 |
| | **Marks** | 2 | 15 | 15 | 15 | 2 | | |
| **Applying** | **Q. Nos** | 1,11(b), 16(a) | 12(b) | 6,13(b) | 14(a) | 9 | | 40.55 |
| | **Marks** | 30 | 13 | 15 | 13 | 2 | | |
| **Analyze** | **Q. Nos** | | 4 | | 15(a),15(b), 16(b) | | | 23.88 |
| | **Marks** | | 2 | | 41 | | | |
| **Evaluate** | **Q. Nos** | | | | 7 | | | 1.11 |
| | **Marks** | | | | 2 | | | |
| **Total** | | 45 | 30 | 30 | 71 | 4 | | 100 |

| | |
|---|---|
| **IQAC Member** | **HOD / Mech** |