Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

III SEMESTER B.TECH. (AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2018

SUBJECT: AUTOMOTIVE STRUCTURES AND DESIGN [AAE 2152]

REVISED CREDIT SYSTEM
(24/11/2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data **IF ANY** may be suitable assumed and clearly mentioned.
- Usage of design data handbook provided is permitted

1A. A 25-mm-diameter shaft is statically torqued to 230 N-m. It is made of cast aluminum, with a yield strength in tension of 160 MPa and a yield strength in compression of 170 MPa. It is machined to final diameter. Estimate the factor of safety of the shaft. **(2)**

1B. The 2-mm-thick bar shown in Fig.1B is loaded axially with a constant force of 10 kN. It is desired to drill a hole through the center of the 40-mm face of the plate to allow a cable to pass through it. A 4-mm hole is sufficient for the cable to fit, but an 8-mm drill is readily available. Will a crack be more likely to initiate at the larger hole, the smaller hole, or at the fillet? **(3)**

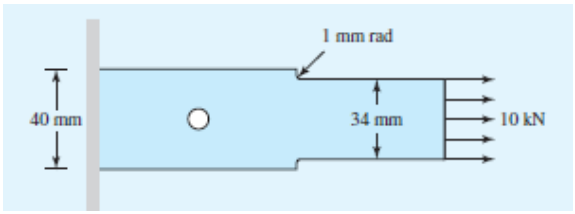

Fig. 1B

1C. A shaft is subjected to a bending load of 3 kN at its end, pure torque of 1000 N-m and an axial pulling force of 15 kN, as shown in Fig. 1C. Calculate the stresses A and B. **(5)**

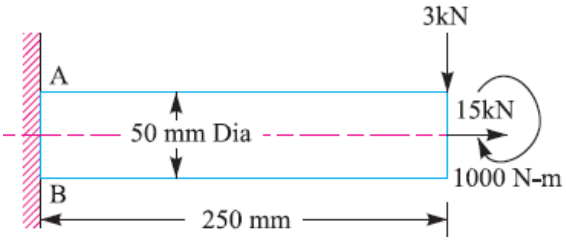

Fig. 1C

2A. A hot rolled steel shaft is subjected to a torsional moment that varies from 330 N-m clockwise to 110 N-m counterclockwise and an applied bending moment at a critical section varies from 440 N-m to – 220 N-m. The shaft is of uniform cross-section and no keyway is present at the critical section. Determine the required shaft diameter. **(6)**

The material has an ultimate strength of 550 MPa and a yield strength of 410 MPa. Take the endurance limit as half the ultimate strength, factor of safety of 2, size factor of 0.85 and a surface finish factor of 0.62

2B. A hollow steel shaft is to transmit 20 kW at 300 r.p.m. The loading is such that the maximum bending moment is 1000 N-m, the maximum torsional moment is 500 N-m and axial compressive load is 15 kN. The shaft is supported on rigid bearings 1.5 m apart. The maximum permissible shear stress on the shaft is 40 MPa. The inside diameter is 0.8 times the outside diameter. The load is cyclic in nature and applied with shocks. The values for the shock factors are Kt = 1.5 and Km = 1.6. **(4)**

3A. A steel solid shaft transmitting 15 kW at 200 r.p.m. is supported on two bearings 750 mm apart and has two gears keyed to it. The pinion having 30 teeth of 5 mm module is located 100 mm to the left of the right hand bearing and delivers power horizontally to the right. The gear having 100 teeth of 5 mm module is located 150 mm to the right of the left hand bearing and receives power in a vertical direction from below. Using an allowable stress of 54 MPa in shear, determine the diameter of the shaft **(7)**

3B. For the above gear-pinion arrangement, from the determined values in Q.3A, draw the force diagram, reaction diagram, SFD and BMD using line diagram approach. **(3)**

4A. What is the objective of a key? Enumerate various types of key used in engineering field. Explain with neat sketches the dimensional parameters of any two types of keys. **(3)**

4B. A bracket is riveted to a column by 6 rivets of equal size as shown in Fig.4C. It carries a load of 100 kN at a distance of 250 mm from the column. If the maximum shear stress in the rivet is limited to 63 MPa, find the diameter of the rivet. **(7)**

5A. Why the square screws are recommended in power screws? Derive an expression, with a neat sketch, for torque required to raise a load using square threaded screws **(5)**

5B. A rectangular steel plate is welded as a cantilever to a vertical column and supports a single concentrated load P, as shown in Fig.5 B. **(3)**
Given: Length of the weld = 60 mm; width of the plate 120mm; Load, P = 60kN; overhang length =160mm; Determine the weld size if shear stress in the same is not to exceed 140 MPa.

5C. With a neat sketch show the terms used in screw (V thread) **(2)**

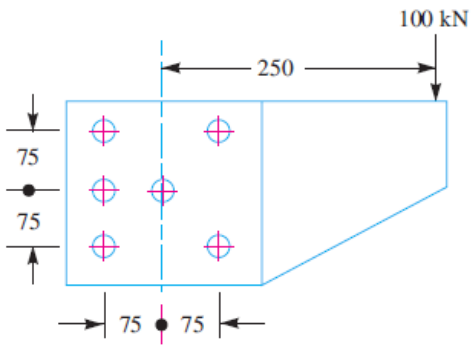

Fig 4C

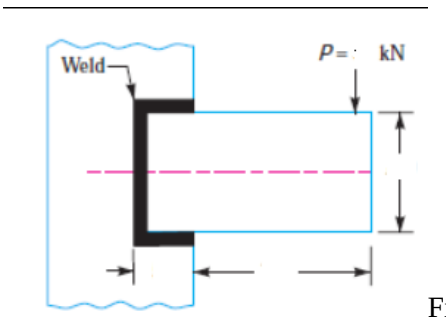

Fig 5B