

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION
DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION
SECOND SEMESTER EXAMINATION 2019/ 2020 SESSION

COURSE CODE: ITE 327

COURSE TITLE: AUTOMOTIVE SCIENCE AND CALCULATIONS

TIME: 2 HOURS INSTRUCTION: ANSWER FOUR QUESTIONS ONLY

- 1a A rope pulley system has two pulleys in each block. An effort of 116 N is required to lift a load of 390 N. Calculate the efficiency of the machine.
- b A hydraulic system on a tipper truck lifts a load of 2 tonnes through a distance of 0.125m while the effort moves through a distance of 20 m. Calculate the:
(i) Velocity ratio; (ii) actual effort required if the efficiency of the lifting system is 75%.
Take $g = 10 \text{ m/s}^2$
- c Define:
Movement ratio ii. Mechanical advantage
- 2a The maximum braking deceleration of a certain vehicle is 7.2 m/s^2 . Calculate the braking efficiency. Take $g = 9.81 \text{ m/s}^2$
- b Calculate the maximum power transmitted by a single plate clutch at a speed of 3600 rev/min if the coefficient of friction is 0.4 and the linings have a radii of 160 mm inner and 190 mm outer. The total spring force is 2.5 kN.
- c State five (5) merits of friction as applied to automobiles
- 3a A mild steel engine bolt when correctly tightened provides a tensile load of 3 kN. The bolt is 300 mm long and has a diameter of 15 mm. Calculate the stress on the material. How much will the bolt extend?
For mild steel $E = 200 \times 10^9 \text{ N/m}^2 = 200 \text{ GN/m}^2$
- b Determine the extension of a metal rod of 14mm diameter and 200mm length when it is placed under a tensile load of 2 tonnes. Take $g=10 \text{ m/s}^2$. The modulus of elasticity E for the material = 200 GN/m^2 .
- c Tensile tests are carried out to find out how a material behaves under different tensile loads. Using the load extension graph, explain the characteristics of the material
- 4a In an experiment to determine the coefficient of friction between brake lining material and steel, a force of 60 Newton steadily moves a block lined with the brake lining material across a steel surface. The block weighs 100 Newton. Calculate the coefficient of friction.
- b State the three (3) basic laws used in the study of motion
- c Define:
i. Friction ii. Machine iii. Force
- 5a A twin plate clutch of inner radius of 250 mm and an outer radius of 320 mm. The total spring force is 4 kN and the coefficient of friction of the linings and the pressure plate and flywheel is 0.35. Calculate the maximum torque that this clutch can transmit.
- b A rack and pinion steering system has 5 teeth of 10 mm pitch and a steering wheel of 320 mm diameter. Calculate the: (a) movement ratio (b) mechanical efficiency of the steering gear if a tangential force of 30 N at the rim of the steering wheel produces a force of 560 N on the rack.
- c Define:
i. Stress ii. Strain iii. Young modulus