

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION
DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION
SECOND SEMESTER EXAMINATION 2018/ 2019 SESSION

COURSE CODE: ITE 327

COURSE TITLE: AUTOMOTIVE SCIENCE AND CALCULATIONS

TIME: 2 HOURS INSTRUCTION: ATTEMPT FOUR QUESTIONS ONLY

- 1a State the three (3) basic laws used in the study of motion
- b The maximum braking deceleration of a certain vehicle is 7.2m/s^2 . Calculate the braking efficiency. Take $g = 9.81\text{m/s}^2$
- c A vehicle travels at a constant speed of 50 km/h for 3 minutes; it then accelerates uniformly to a speed of 80 km/h in a period of 2 minutes. Draw a speed against time graph and determine the distance covered by the vehicle in the 5-minute period.
- 2a Differentiate between static and sliding friction
- b State five (5) merits of friction as applied to automobiles
- c In an experiment to determine the coefficient of friction between brake lining material and steel, a force of 60 newtons steadily moves a block lined with the brake lining material across a steel surface. The block weighs 100 newtons. Calculate the coefficient of friction.
- 3a 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 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.
- 4a Define:
- i. Friction ii. Machine iii. Force
- b In a test-station brake-test on a vehicle, the front brake forces total 2200 N and the rear brake forces total 1400 N. If the vehicle has a mass (weight) of 1.2 tonne, calculate the braking efficiency. Take $g = 9.81\text{ m/s}^2$
- c State Hookes law
- 5a Define:
- i. Stress ii. Strain iii. Young modulus
- b A steel tie rod used in a suspension system is 400 mm long with a diameter of 15 mm. Determine the stress on the tie rod when a tensile force of 600 N is applied to it under braking
If E for the rod = 200 GN/m^2 calculate the extension of the rod caused by this force
- 6a Define:
- i. Velocity ratio ii. Mechanical advantage
- 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 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.