Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/B.TECH (AUE)/SEM-6/AUE-602/2012

2012
VEHICLE BODY ENGINEERING

Time Allotted : 3 Hours   *Full Marks* : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

### GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following :

$$10 \times 1 = 10$$

   i)   If the tractive effort at any point of motion is more than the resistance of a vehicle, the vehicle will be under

      a)   Acceleration   b)   Deceleration

      c)   Uniform speed   d)   Instant rest.

   ii)   The propellant of an automobile air bag contains

      a)   Sodium azide & Potassium nitrate

      b)   Potassium chlorate and nitric acid

      c)   Sodium carbonate and water

      d)   Lead Peroxide and Sulphuric acid.

6123   [Turn over

iii) In double decker bus, passengers are not allowed to stand on the top deck because

    a) passengers' ventilation is effected

    b) overall centre of gravity of the bus changes

    c) upper deck floor may be collapsed

    d) bus may vibrate vigorously.

iv) Aerodynamic force on vehicle depends on

    a) road gradient

    b) frictional force between road and tyre

    c) vehicle speed

    d) none of these.

v) Wind shield is made of

    a) thin aluminium sheet

    b) thin steel sheet

    c) glass sheet

    d) thin copper sheet.

vi) Magnitude of driving wheel torque is ……………… than engine torque.

    a) less   b) greater

    c) equal

vii) Maximum tractive effort in a 4-speed gear box vehicle is available in the

    a) first gear   b) second gear

    c) third gear   d) fourth gear.
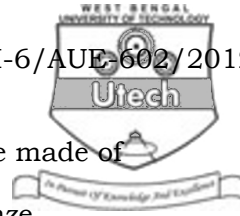
viii) Piston rings of automobile engines are made of

    a)   brass   b)   bronze

    c)   cast iron   d)   copper.

ix)   Cylinder block of an automobile engine is made of

    a)   Stainless steel   b)   Alloy cast Iron

    c)   Carbon steel   d)   High tensile steel.

x)   The coefficient of rolling resistance for a truck weighting 62293.5 N is 0.018 and the coefficient of air resistance is 0.0276 in the formula $R = KW + K_a AV^2$. The frontal area A is 5.574 m^2 and the speed of the vehicle is 88 km/h. The required engine BP is

    a)   60 N   b)   62.8 N

    c)   61.2 N   d)   62 N.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.   3 × 5 = 15

2.   Briefly describe the operation of air bags and their actuating mechanism with neat sketches.

3.   What is window regulator ? Briefly discuss the function of window regulator with sketch.

4. What are the various types of body materials used in vehicle body ? Briefly write their properties.

5. A car is moving with a speed of 90 km/h. The air temperature is 20°C and pressure is 80 kPa. The frontal area of car is 1.75 m^2 and coefficient of drag is 0.32. Calculate the aerodynamic drag.

6. Outline the essential feature of the following types of automotive vehicles :

   i) Sedan Car ii) Limousine iii) Estate car.

GROUP – C

(Long Answer Type Questions)

Question No. 7 is compulsory and any *two* of the following.

15 + (2 × 15) = 45

7. In Figure, curves A-F are curves of total resistance for a road with a uniform surface but of varying gradient, curve A being the level and curve F the steepest gradient. Curves RS, TU and VW are curves of tractive effort for three different gear ratios, RS being, say, the top gear, TU the next lower gear, etc.

With reference in Figure comment on the vehicle performance at each of the following scenarios outline below. Substantiate your argument with the help of curves shown in the figure.
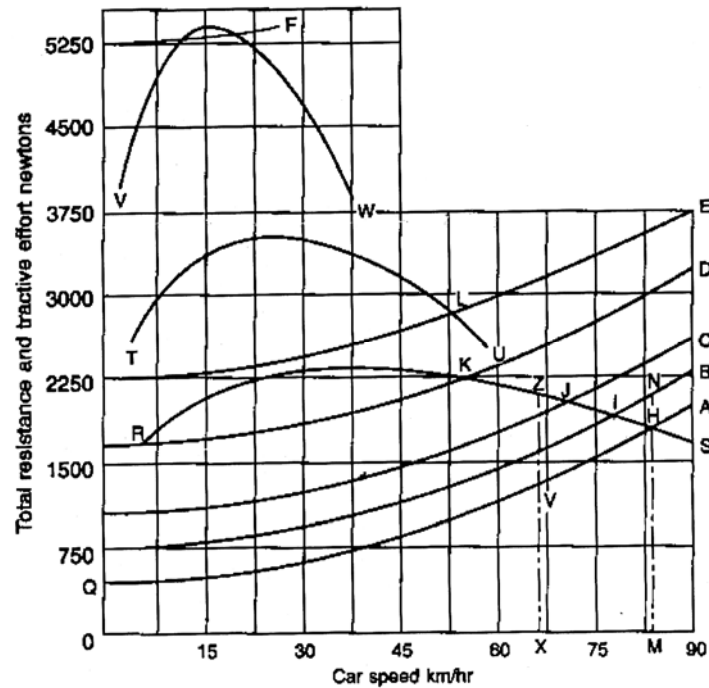

Fig.

i) A vehicle is travelling on the level at a speed 70 Km/hr in the third gear ratio.

ii) The vehicle after reaching stable condition suddenly encounters a resistance depicted by curve D

iii) Then the vehicle encounters a total resistance of 3000 N. What action has to be taken and what will be the final speed of the vehicle.

8. a) With the help of net layout sketches, describe the body structures of the following types of automotive vehicle.

    i)   Mini Bus

    ii) Single Deck Bus

    iii) Double Deck Bus and Articulated Double Deck Bus   2 + 3 + 4

    b) For a typical motor car, the road resistance is given by 23 N per 1000N weight, the air resistance by the expression $0.0827V^2$, the transmission efficiency 88% in top speed, car weight 19934 N when fully loaded. Calculate :

    i)   The power required by the vehicle (bKW) for a top spped of 144 Km/hr.

    ii) The acceleration in m/s^2 at 48 Km/hr, assuming the torque at 48 Km/hr in the top gear 25% more than at 144 Km/hr.

    iii) The bK W required to drive the car up a gradient of 1 in 5 at 48 Km/hr and the transmission efficiency is 80% in bottom gear.   6

9. a) Define coefficient of Drag. What are the factors that affect rolling resistance ? How is rolling resistance related to vehicle speed ?   2 + 3 + 3

    b) With proper sketch explain how the pressure and velocity must vary in gross air flow over a car.   7

10. Define the term windshield. Discuss different types of vehicle door with neat sketch. Also describe the advantages and disadvantages of each door.   2 + 7 + 6
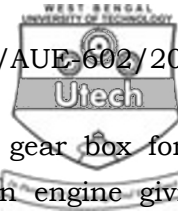
11. Determine the gear ratios of a four speed gear box for a vehicle of weight 13341.6 N powered by an engine giving 20.6 kW at 1800 rpm. The vehicle has a frontal area of 2.23 m^2 and has a wheel diameter 0.71 m. The maximum gradient that the car has to negotiate is 1 in 4. The rolling resistance may be taken as 50 N per 2240 N of car. The wind resistance is given by $0.03679AV^2$, where A is the frontal area in m^2 and V is the vehicle speed in km/h. Assume that the transmission efficiency is 0.75 and that at top gear, the car is expected to go over a grade of I in 40. State any other assumption you make.

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