

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE- VII<sup>th</sup> SEMESTER-EXAMINATION – MAY/JUNE- 2012****Subject code: 171902****Date: 08/06/2012****Subject Name: Automobile Engineering****Time: 02:30 pm – 05:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) i) Write about important events of history of an Automobile. Also write few name of vintage car. **04**
- ii) ) “Stability & safety in a modern car is greatly improved” comment on the statement **03**
- (b) i) How is the car specified? Draw schematic diagram showing the layout of the transmission system of a four wheel drive vehicle. **04**
- ii) What are the periodic observations, replacement of parts/fillings required over few thousand kilometers running of an Automobile? **03**
- Q.2** (a) i) Evaluate the statement: **05**
- (i) Diaphragm clutch is more popular in most of the modern car.
  - (ii) Synchromesh device is not used in first & reverse gear.
  - (iii) Most of the modern cars are front wheel drive.
  - (iv) Automatic transmission system is more comfortable even though it is not used in Indian cars.
  - (v) Automobiles have gone electronic oriented from mechanical based system.
- ii) Write short note on CNG or LPG as a engine fuel. **02**
- (b) A motor car weighs 11200 N & the engine develops 41 kW at 4500 rpm, The combined air & rolling resistance is given by the formula  $R = 40.3 + 0.051V^2$ , where R is in Newton & V in km/hr. The performance characteristic is such that it will reach 120.5 km/hr at 4500 rpm & full throttle when engine is running in still air. At the same engine speed in second gear, it will just climb a gradient of 1:10. The top & second gear ratio is 5:1 & 8:1 respectively. Calculate: **07**
- (i) The efficiency of transmission in I<sup>st</sup> & II<sup>nd</sup> gear.
  - (ii) The engine power required for second gear when climbing up a gradient of 1: 20 at 48 km/hr.

**OR**

- (b) A motor car takes a right turn of 90 m mean radius at speed of 90 km/hr. Each road wheel has moment of inertia of 2.0 kgm<sup>2</sup> & effective radius of 0.4 m. The rotating parts of the engine weighing 650 N having a radius of gyration of 0.1m. Engine flywheel rotates in clockwise direction when viewed from rear. The back axle ratio is 4: 1. The car weight is 900 kg & its CG is 0.9 m above ground level. Determine the magnitude of the centrifugal & gyroscopic couple stating its direction. Which of the wheel likely to be lifted first if speed increased? **07**

- Q.3 (a)** i) Explain the principle of a friction clutch. Discuss the desirable properties of friction material for the clutch plate. **03**  
 ii) With the help of road performance curve explain the necessity of gear box in an Automobile. **02**  
 iii) Compare hotch kiss drive & torque tube drive. **02**
- (b)** An Automobile is fitted with a cone clutch have the following parameters: **07**  
 Face width of lining material = 0.071m  
 Effective mean diameter = 0.285m  
 External radius = 0.15m  
 Coefficient of friction = 0.3  
 Axial force applied = 1050 N  
 Moment of inertia of rotating parts = 4.4 kg.m<sup>2</sup>  
 Speed = 1225 rpm  
 The clutch works under uniform wear condition.  
 Calculate the time required to attain full speed & energy lost in slipping.

**OR**

- Q.3 (a)** i) Compare hotch kiss drive & torque tube drive. **02**  
 ii) Draw schematic diagram of differentia unit. **02**  
 iii) Sketch arrangement of fully floating rear axle & identify various loads that it has to withstand. **03**
- (b)** A constant mesh gear box which gives three forward speeds. Above gear box gives a top gear ratio of unity & first gear ratio of 3.3:1. The centre distance between lay shaft & engine shaft is to be 13 cm & lay shaft speed is half of the engine shaft speed. Gear teeth of module 3.1 mm are to be employed. Design a gear box giving the number of teeth of various gears and find exact gear ratio. **07**

- Q.4 (a)** i) Derive the formula for reaction coming on front & rear wheel of a car when it descending a hill and brake applied to front wheel only in terms of coefficient of friction, gradient, weight of vehicle & vehicle dimensions **04**  
 ii) Draw & explain working of a tandem master cylinder. State the function of fluid check valve & bypass port in it. **03**
- (b)** The distance between king pins of a car is 140 cm. The stub axle & track arm are 180 mm and 200mm respectively. The length of the track rod is 130 cm. **07**  
 Determine wheel base which will gives true rolling for all wheels when the car is turning so that the inner wheel stub axle is making 60° to the centre line of the car. Also find turning circle radius of all the wheels.

**OR**

- Q.4 (a)** i) Define the following terms: **04**  
 (i) Power steering (ii) Adjustable steering  
 (iii) Collapsible steering (iv) Centre point steering
- ii) Explain the following terms: **03**  
 i) -ve camber angle (ii) -ve castor angle (iii) -ve scrub radius

**Q.4 (b)** A motor car provided with Ackermann steering mechanism have **07** following

dimensions:

Length of track arm	= 22.5 cm
Length of each stub axle	= 25.0 cm
Length of track rod	= 135 cm
Length of wheel track	= 200 cm
Outside lock angle	= $35^{\circ}$
Height of CG from ground	= 60 cm
Distance of CG from front axle	= 170 cm
Car speed on level track	= 80 km/hr
Coefficient of friction	= 0.65

Determine minimum distance in which the car may be stopped when:

- (i) Front wheels are braked.
- (ii) Rear wheels are braked.
- (iii) All four wheels are braked.

**Q.5 (a) i)** Differentiate clearly between the working of : **04**

- (i) Spring & shock absorber
- (ii) Antiroll bar & pan hard rod
- (iii) Conventional & independent suspension
- (iv) Hydrolastic & Hydragas suspension system

ii) With the neat sketch explain the working of a telescopic shock absorber. **03**

**(b) i)** Describe battery operation by showing chemical reaction in a lead acid battery. Write about different test carried out to know the condition of battery. **04**

ii) What is the function of following: **03**

- (i) Sun visor (ii) Sliding roof (iii) Winch

**OR**

**Q.5 (a) (i)** Draw cross section of an automobile tyre. How it is specified? **03**

(ii) Describe the requirement of a wheel. Draw & explain alloy cast wheel. **04**

**(b) i)** What are the different safety provisions made in a modern car? **03**

ii) Write about Hybrid vehicle and concept car. **02**

iii) Distinguish between full insurance and third party insurance. **02**

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