

CS/B.Tech/AUE/Even/Sem-6th/AUE-602/2015



WEST BENGAL UNIVERSITY OF TECHNOLOGY

AUE-602

POWER UNIT AND TRANSMISSION

Time Allotted: 3 Hours

Full Marks: 70

*The questions are of equal value.**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. Answer all questions.

10 × 1 = 10

(i) In case of cone clutch-

- (A) axial force is more than normal force at contact surface  
 (B) normal force is more than axial force at contact surface  
 (C) axial force = normal force at contact surface  
 (D) none of these

(ii) In a gear box the clutch shaft pinion has 14 teeth and low gear main shaft pinion has 32 teeth. The corresponding lay shaft pinions have 36 and 18 teeth. What will be the gear ratio-

- (A) 4.57:1 (B) 3.3:1 (C) 6.5:1 (D) 2:1

(iii) In a simple epicyclic gear set, the output member to increase torque in reverse is always the-

- (A) planet carrier (B) ring gear (C) sun gear (D) none of these

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(iv) The component of the torque converter that redirects the flow of oil to impeller is-

- (A) turbine (B) impeller (C) stator (D) free wheel

(v) In a fluid coupling the greater the difference between the speed of the driving and driven number.

- (A) the higher the coupling efficiency  
 (B) the lower the turbulence  
 (C) the lower the coupling efficiency  
 (D) none of these

(vi) Poly phase torque converter has-

- (A) multiple impeller (B) multiple runner  
 (C) multiple stator (D) multiple clutch

(vii) Clutch facings are usually attached to the plate by

- (A) steel rivets (B) brass rivets  
 (C) aluminium rivets (D) copper rivets

(viii) Main function of gear box-

- (A) reduced speed (B) torque multiplication  
 (C) transmit power (D) drive wheels

(ix) Function of cushion spring in clutch plate-

- (A) transmit power (B) dampen torsional vibration  
 (C) torque multiplication (D) none of the above

(x) As slip % increases, torque in a torque converter-

- (A) decrease (B) increase (C) no change (D) no relation

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**GROUP B**  
(Short Answer Type Questions)

Answer any *three* questions.

3×5 = 15

2. A transmission system for a vehicle is to have an overall bottom and top gear ratio of 20:1 and 4.8:1 respectively. If the minimum to maximum speed at each gear changes are 2100 and 3000 rev/min respectively, determine the following
  - (a) the intermediate overall gear ratios
  - (b) the intermediate gearbox and top gear ratios.
3. A vehicle weighing 1500 kg has co-efficient of rolling resistance of 0.015. The transmission has a final drive ratio 4.07:1 and an overall mechanical efficiency of 85%. If the engine develops a maximum torque of 100 Nm and the effective road wheel radius is 0.27m, determine the gearbox bottom gear ratio. Assume the steepest gradient to be encountered is a one in four.
4. Explain the Janny hydrostatic transmission with a sketch.
5. Find the axial force required to synchronize the speed. Given co-efficient friction is 0.04, cone angle is 10°, angular acceleration is 50 rad/sec<sup>2</sup>, moment of inertia 250 kg cm<sup>2</sup> and the mean radius of cone surface 4.13 cm.
6. Write short notes on Continuous Variable Transmission (CVT).

**GROUP C**  
(Long Answer Type Questions)

Answer any *three* questions.

3×15 = 45

7. (a) An automobile clutch has a clutch plate of 150mm inside and 230mm outside diameter. Six springs in the clutch provide a total force of 4.8 KN, when the clutch is new and each spring is compressed 5 mm. The maximum torque developed by the automobile engine is 250N-m. Determine-
  - (i) Factor of safety for the new clutch
  - (ii) The amount of wear of the clutch facing that will take place before the clutch starts slipping; Assume co efficient of friction is 0.3

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- (b) Explain the construction and operation of a centrifugal type clutch with a neat sketch

8. (a) Explain the necessity of a gear box for a vehicle using performance curves analysis. 5+10

- (b) Rolling resistance of a truck of a mass 8000 kg on level road is given by-

$$R_T = 0.0112 mg + 0.00006 mgV + 0.02688AV^2$$

Where m is mass in kg, V is speed in km/hr, A is the frontal area in m<sup>2</sup>. The transmission efficiency in top gear of 6.2:1 is 90% and that in 2<sup>nd</sup> gear of 18:1 is 85%. The frontal area is 6m<sup>2</sup>. If the truck has to reach maximum speed of 90 km/hr in top gear, Calculate-

- (i) The demand horsepower
- (ii) The engine speed, when driving wheel effective diameter is 0.85m
- (iii) The maximum grade the truck can negotiate in 2<sup>nd</sup> gear.
- (iv) The maximum draw bar pull available on level road at the above engine speed.

9. (a) An overdrive simple epicyclic gear train has sun and annulus gears with 21 and 75 teeth respectively. If the input speed from the engine drives the planet carrier at 3000 rev/min, Determine- 10+5

- (i) the overdrive gear ratio
- (ii) the number of planet gear teeth
- (iii) the annulus ring and output shaft speed,
- (iv) the percentage of overdrive

- (b) What is a synchronizing device in synchromesh gear box? How this device helps smooth gear engagement?

10. Explain the principle of operation of hydrokinetic three element torque converter with velocity diagrams. 15

11. Write short notes on any *three* of the following: 3×5

- (a) Parallel hybrid vehicle
- (b) Modified ward Leonard type electric drive
- (c) Lock up torque converter
- (d) Front engine front wheel drive

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