

CS/B.Tech/AUE/Even/Sem-6th/AUE-605A/2015



WEST BENGAL UNIVERSITY OF TECHNOLOGY

AUE-605A

DESIGN OF AUTOMOTIVE SYSTEMS

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) The ball bearing is usually made from
 (A) Low carbon steel (B) Medium carbon steel
 (C) High speed steel (D) Chrome nickel steel
- (ii) A brake commonly used in motor car is-
 ✓(A) Shoe brake (B) Band brake
 ✓(C) Internal expanding brakes (D) Band and block brake
- (iii) Goodman's line and Soderberg line relate to-
 ✓(A) The fatigue strength for radius combination of stress levels
 (B) The theory of maximum shear stress
 (C) Permissible level of noise in an industrial environment
 (D) none of these
- (iv) A Jaw clutch is a-
 (A) Positive clutch (B) Friction clutch
 (C) Centrifugal clutch ✓(D) Cone clutch

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Turn Over

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- (v) Brakes convert -
 (A) Heat energy into kinetic energy
 ✓(B) Kinetic or potential energy to the heat energy
 (C) Heat energy into potential energy
 (D) Kinetic energy into potential energy
- (vi) Due to the centrifugal force acting on the rim, the flywheel arms are subjected to
 ✓(A) tensile stress (B) compressive stress
 (C) shear stress (D) none of these
- (vii) The maximum fluctuation of speed is the
 (A) difference of minimum fluctuation of speed and the mean speed
 ✓(B) difference of the maximum and minimum speeds
 (C) sum of the maximum and minimum speeds
 (D) variations of speed above and below the mean resisting torque line
- (viii) The length of the piston usually varies between
 ✓(A) D and 1.5 D (B) 1.5 D and 2 D
 (C) 2D and 2.5 D (D) 2.5 D and 3 D
 Where D = Diameter of the piston
- (ix) Lewis equation in spur gears is used to find the
 (A) tensile stress in bending (B) shear stress
 ✓(C) compressive stress (D) fatigue stress
- (x) Life of a ball bearing is inversely proportional to
 ✓(A) (Load)^{1/3} (B) (Load)³
 (C) (Load)^{1/2} (D) (Load)²

GROUP B
(Short Answer Type Questions)

Answer any three questions.

3×5 = 15

2. What is a clutch? What for a clutch is used in an automobile?

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3. Explain why worm gear reduction units are not preferred over other types of gear boxes for transmitting large power. What are the materials for worm and worm wheel? Explain why dissimilar materials are used for manufacturing worm and worm wheel?
4. A bronze spur pinion rotating at 560 r.p.m. drives a cast steel gear. The transmission ratio is 4, the pinion has 18 teeth with 20° full depth involute profile. The module being 5 mm, the face width of the gearing is 25 mm. Determine the power that can be transmitted from the stand point of strength. Static strength for the bronze is 80 MPa and for cast steel, it is 100 MPa.

$$\text{Given that Lewis form factor} = 0.154 + \left(\frac{0.912}{T} \right)$$

$$C_v = \frac{3}{(3 + v)}$$

5. What do you understand by "fluctuation of energy" and maximum fluctuation of energy
6. Write short notes on classification and different types of antifriction bearings

GROUP C

(Long Answer Type Questions)

Answer any *three* questions.

3 × 15 = 45

7. The areas of the turning moment diagram for one revolution of a multi-cylinder engine with reference to the mean turning moment, below and above the line are - 32, + 408, - 267, + 333, - 310, + 226, - 374, + 260, and - 244 mm². The scale for abscissa and ordinate are 1 mm = 2.4° and 1 mm = 650 N-m respectively. The mean speed is 300 r.p.m. with a percentage speed fluctuation of ± 1.5%. If the hoop stress in the material of the rim is not to exceed 5.6 MPa, determine the suitable diameter and cross-section for the flywheel. Assuming that the width is equal to 4 times the thickness. The density of the material may be taken as 7200 kg/m³. Neglect the effect of the boss and arms.

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8. A pairs of helical gears are to transmit 15 k.w. The teeth are 20° stub in diametral plane and have a helix angle of 45°. The pinion runs at 10 000 r.p.m. and has 80 mm pitch diameter. The gear has 320 mm pitch diameter. If the gears are made of cast steel having allowable static strength of 100 MPa; determine a suitable module and face width from static strength considerations and check the gears for wear, given $\sigma_{es} = 618 \text{ Mpa}$. 15
9. Design a cast iron piston for single acting 4 stroke engine in the following data cylinder box = 100 mm, stroke length = 125 mm, maximum pressure = 5 N/mm²; indicated mean effective pressure = 0.75 N/mm². Mech. efficiency = 80%; fuel consumption = 0.1519 per B.P(Hr) ; higher calorific value of fuel = 42 × 10³ kJ/kg, speed = 2000 r.p.m. Assume any other data. 15
10. A plate clutch having a single driving plate with contact surfaces on each side is required to transmit 110 kW at 1250 r.p.m. The Outer diameter of the contact surfaces is to be 300 mm. The coefficient of friction is 0.4.
 - (a) Assuming a uniform pressure of 0.17 N/mm²; determine the inner diameter of the friction surfaces.
 - (b) Assuming the same dimensions and the same total axial thrust, determine the maximum torque that can be transmitted and the maximum intensity of pressure when uniform wear conditions have been reached.
11. A full journal bearing of 50 mm diameter and 100 mm long has a bearing pressure of 1.4 N/mm². The speed of the journal is 900 r.p.m. and the ratio of journal diameter to the diametral clearance is 1000. The bearing is lubricated with oil whose absolute viscosity at the operating temperature of 75 °C may be taken as 0.011 kg/m-s. The room temperature is 35 °C. find: 15
 - (a) The amount of artificial cooling required.
 - (b) The mass of the lubricating oil required. If the difference between the outlet and inlet temperature of the oil is 10 °C. Take specific heat of the oil as 850 J/kg/°C.