Roll No: ----------

UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program Name: B.tech / ADE | **Semester – VII**
Course Name : Automotive engine component design | **Max. Marks : 100**
Course Code : ADEG 431 | **Duration : 3 Hrs**
No. of page/s: 02

Section – A

(Attempt all questions. All questions carry equal marks) ***(4 x 5 = 20 Marks)***

1. List out general failure considerations in design
2. State the important mechanical properties of materials
3. Write the equation which defines the relationship between static stress, variable stress, Ultimate stress, endurance stress and stress factor.
4. Name the methods to find the failure for combined steady and variable stresses.

Section – B

(Attempt all questions. All questions carry equal marks) ***(4 x 10 = 40 Marks)***

5. Describe the reactions diagram of center crankshaft at maximum dead center and at angle of maximum twisting moment.

(Or)

6. A single cylinder I.C engine working on four-stroke cycle develops 75kw at 360 rpm. The maximum fluctuations of energy can be assumed to be 0.9 times the energy developed/cycle. If the total fluctuation of speed is not to exceed 1% and maximum centrifugal stress in the flywheel is to be 5.5 MN/m^2, Estimate the mean diameter and cross sectional area of the rim.
   Flywheel is made of cast iron.

7. The maximum combustion pressure in an automotive diesel engine is 7MPa. Cylinder bore is 0.127m. Determine the desirable I-section for the middle of the connecting rod of 0.3175m long. If the engine stroke is 0.127m and maximum speed is 2000 rpm, then determine the whipping stress in the connecting rod.

8. The conical valve of an IC engine is 60mm in diameter and is subjected to a maximum gas pressure of 4N/mm^2. The safe stress in bending for the valve material is 46MPa. The valve made of steel for which k=0.42. The angle at which the valve disc seat is tapered is 30^o. Determine:

    a. Thickness of the valve head,
    b. Stem diameter and
    c. Maximum lift of the valve

9. A Hartnell governor having a central sleeve spring and two right-angled bell crank levers moves between 290rpm and 310rpm for a sleeve lift of 15mm. The sleeve arms and the ball arms are 80mm and 120mm respectively. The levers are pivoted at 120mm from the governor's axis and mass of each ball is 2.5 kg. The ball arms are parallel to the governor axis at the lowest equilibrium speed. Determine:
    a. Loads on the spring at the lowest and highest equilibrium speeds,
    b. Stiffness of spring.

Section – C

(Attempt all questions. All questions carry equal marks) (2 x 20 = 40 Marks)

10. Design a plain carbon steel crankshaft for a 0.40m by 0.60 m single acting 4-stroke diesel engine to operate at 200 rpm. The mean effective pressure is 0.490MPa and the maximum combustion pressure is 2.624MPa at a maximum torsional moment. When the crank angle is 36^0, the gas pressure is 0.975 MPa and the ratio of connecting rod length to crank radius is 4.8. The flywheel is used as a pulley. The weight of the flywheel is 54.50kN and the total belt pull is 6.75kN. Assume the suitable values for the missing data.

(Or)

11. Design the overhung crankshaft with two main bearings and a flywheel for an IC engine having single cylinder of 0.25x0.30m. The flywheel weighs 27kN.The maximum pressure is 2.1MPa. The torsional moment is maximum, when the crank is at 35^0 from IDC while the pressure is 1.05 MPa.

12. Design a cylinder for an 1100 CC six-cylinder car engine with the following data:
    i. Power 40kw at 4400 rpm.
    ii. Mean effective pressure =1 N/mm^2
    iii. Mechanical efficiency =80 percent.

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Section – A

(Attempt all questions. All questions carry equal marks) ***(4 x 5 = 20 Marks)***

1. State the functions of flywheel in a machine
2. Name the common modes of failure in piston, connecting rod and cylinder
3. List out the design considerations to avoid fatigue failure
4. Draw the reactions diagram of center crankshaft at maximum dead center and at angle of maximum twisting moment.

Section – B

(Attempt all questions. All questions carry equal marks) ***(4 x 10 = 40 Marks)***

5. Describe the reactions diagram of overhung crankshaft at maximum dead center and at angle of maximum twisting moment.

(Or)

6. The speed of a C.I. flywheel is limited to 5 m/s at mean radius. The flywheel runs at 50 rpm and supplied 12000 N-m energy during punching. The actual punching times occupies 30^o rotations of wheel and speed drops by 20%. Find the cross section of the rim and check the same for maximum induced stress.

7. Check the suitability of I-section 15mm x 12mm for designing the connecting rod on the case of single motor cycle engine of 40mm bore and 50mm stroke where the maximum pressure produced is 3.6MPa and in which the connecting rod is 4 times crank.

8. Determine the thickness of the valve head, Stem diameter and Maximum lift of the valve For the following data, the conical valve of an IC engine is 50mm in diameter and is subjected to a maximum gas pressure of 3.2 N/mm^2. The safe stress in bending for the

valve material is 35 MPa. The valve made of steel for which k=0.38. The angle at which the valve disc seat is tapered is 32^o

9. In a spring-loaded governor of the Hartnell type, the mass of the each ball is 1 kg. length of the vertical arm of the bell crank lever is 10omm and that of the horizontal arm is 50mm. The distance of fulcrum of each ball crank lever is 80mm from the axis of rotation of the governor. The extreme radius of rotation of the balls are 75mm and 112.5mm. The maximum equilibrium speed is 5 per cent greater than the minimum equilibrium speed, which is 360rpm. Find the neglecting obliquity of arms, initial compression of the spring and equilibrium speed corresponding to the radius of rotation of 100mm.

Section – C

(Attempt all questions. All questions carry equal marks) (2 x 20 = 40 Marks)

10. Design an overhung crankshaft for an I.C. engine for the following data: Stroke=300mm, cylinder bore =250 mm, length of the connecting rod = five times the crank radius, maximum gas pressure =$2N/mm^2$, gas pressure when the torque is maximum =$1N/mm^2$ and the crank angle when he torque is maximum=35^0.

(Or)

11. Design a center crank for an I.C. engine with bore of 150mm and stroke of 200mm. Length of the connecting rod is 400 mm. Maximum gas pressures is $300N/cm^2$. The maximum torque is at 35^0 of crank angle when the gas pressure is 1 MPa. Design stress is $60N/mm^2$. Distance between main bearings of the crank is 400mm.

12. Determine the principle dimensions of cylinder for a vertical four –stroke compression ignition engine from the following data:
    Brake power=45kw, speed=1200 rpm.
    Indicated mean effective pressure=700 kN/m^2
    Mechanical efficiency =80 percent.