03/12/2018.

Paper / Subject Code: 41603 / Automotive Design

BE Auto / Sem VII / CBGS / Second half 2018

(03 Hours) Marks: 80

Note:
1. Question No. 1 is compulsory.
2. Attempt any **Three** questions from remaining.
3. Use of Design Data Hand book is permitted.
4. Assume suitable data if required.

1. Attempt any Four of the following 4 X 5 =20

(a) Explain Design considerations of cylinder. What are dry and wet Cylinder liners?

(b) What are the design requirements of piston? Name two criteria for calculating the thickness of piston head.

(c) An universal coupling is used to connect two mild steel shafts transmitting a torque of 6500 N-m. Assuming that the shafts are subjected to torsion only, find the diameter of the shafts and pins. The allowable shear stresses for the shaft and pin may be taken as 65 MPa and 30 MPa respectively.

(d) Why are connecting rods made of I-section? Explain Whipping stress.

(e) Prepare a list of brake lining and clutch lining materials used in automotive. Specify their characteristics.

2. (a) The bore of a cylinder of the four stroke diesel engine is 150 mm. (15)
The maximum gas pressure inside the cylinder is limited to 4.5 MPa .The cylinder head is made of cast iron and allowable tensile stress is 45 N/mm^2 .Determine the bore and length of the cylinder liner, thickness of cylinder liner, thickness of cylinder head .
The studs which are made of steel, have allowable stress as is 60 N/mm^2.
Calculate (i) number of studs, (ii) nominal diameter of studs, and (iii) pitch of studs.
Draw the neat diagram for each component.
Any other data required for the design may be assumed.

(b) A centrifugal clutch, transmitting 25 kW at 850 rpm consists of four shoes. (05)
The clutch is to be engaged at 700 rpm The inner radius of the drum is 185 mm. The radius of the center of gravity of the shoes is 160 mm, when the clutch is engaged. The coefficient of friction is 0.25, while the permissible pressure on friction lining is 0.2 N/mm^2
Calculate: (i) the mass of each shoe; and (ii) the dimensions of friction lining.

3. (a) Determine the dimensions of cross-section of the connecting rod, using the following data: 10

Cylinder bore	= 100 mm
Stroke	= 120 mm
Length of connecting rod	= 290 mm
Speed	= 2200 rpm
Mass of reciprocating parts	= 1.5 kg
Maximum gas pressure	= 3.625 MPa
Factor of safety against buckling	= 5

(b) Design an exhaust valve for a horizontal diesel engine using the following data:: (10)

Cylinder bore = 250 mm
Length of stroke = 300 mm
Engine speed = 600 rpm
Maximum gas pressure = 4 MPa
Seat angle = 45°
Mean velocity of gas through port = 50 m/s
Allowable bending stress for valve = 50 N/mm^2

Calculate: (i) Diameter of the valve port; (ii) Diameter of the valve head; (iii) Thickness of the valve head; (iv) Diameter of the valve stem

4. (a) A semi-elliptic multi-leaf spring is used for the suspension of the rear axle of a truck. (10)
It consists of two extra full-length leaves and 12 graduated-length leaves including the master leaf. The centre-to-centre distance between the spring eyes is 1.2 m. The leaves are made of steel σ = 600 N/mm^2 and E = 2x10^5 N/mm^2. The spring is to be designed for a maximum force of 40 kN The leaves are pre-stressed so as to equalize stresses in all leaves. Determine
(i) The cross-section of leaves; and
(ii) The deflection at the end of the spring.
Any other data required for the design may be assumed.

(b) Design of a cast iron piston for a single acting four stroke for the following data: (10)

Cylinder bore = 100 mm;
Stroke = 120 mm;
Maximum gas pressure = 6 N/mm^2
Indicated mean effective pressure = 0.8 N/mm^2;
Mechanical efficiency = 85%
Fuel consumption = 0.15 kg per brake power per hour;
Higher calorific value of fuel = 42 × 10^3 kJ/kg;
Speed = 2000 r.p.m.

Any other data required for the design may be assumed.

5. (a) An automobile vehicle weighing 13.5 kN is moving on a level road at a speed of 95 km/h. When the brakes are applied, it is subjected to a uniform deceleration of 6 m/s^2. There are brakes on all four wheels. The tyre diameter is 750 mm. The kinetic energy of the rotating parts is 10% of the kinetic energy of the moving vehicle. The mass of each brake drum assembly is 10 kg and the specific heat capacity is 460 J/kg°C. (10)

Calculate

(i) the braking time;
(ii) the braking distance;
(iii) the total energy absorbed by each brake;
(iv) the torque capacity of each brake; and

(b) A 4 forward speed sliding mesh gearbox contains Speed ratio of clutch shaft gear and lay shaft gear is 2. Calculate the number of teeth in all the gears with the assumptions that minimum number of teeth required for any gear to avoid interferenece is 18. Finally, calculate actual gear ratios. The gearbox should have the following speed ratios approximately: (10)

First gear = 5
Second gear = 3.38
Third gear = 2.25
Fourth gear = 1
Reverse speed gear = 5.5

Also calculate the Centre distance between shafts by assuming module.

6.(a) Design a centre crankshaft for single cylinder vertical engine using the following data (10)

Cylinder bore = 125 mm
Stroke = 150 mm
(L/r) ratio = 4.5
Speed = 2000 rpm
Weight of flywheel cum belt pulley = 1kN
Maximum gas pressure = 3 MPa
Total belt pull = 2 kN
Width of hub for flywheel cum belt pulley = 250 mm

The torque on the crankshaft is maximum when the crank turns through 22° from TDC and at this position the gas pressure inside the cylinder is 2.5 MPa. The belts are in horizontal direction

(b) An automotive plate clutch uses six helical compression springs which are arranged in parallel (10) and provide the axial thrust of 1200 N. The springs are compressed by 8 mm to provide this thrust force. The springs are identical and the spring index is 6. The springs are made of cold-drawn steel wires with ultimate tensile strength of 1200 N/mm^2. The permissible shear stress for the spring wire can be taken as 50% of the ultimate tensile strength (G = 81 370 N/mm^2). The springs have square and ground ends. There should be a gap of 1 mm between adjacent coils when the springs are subjected to the maximum force. Design the springs and calculate: (i) mean coil diameter; (ii) total number of coils; (iii) solid length; (iv) free length; (v) required spring rate