



**ENTER B.E/B.TECH DEGREE EXAMINATIONS: NOV/DEC 2023**

(Regulation 2018)

Sixth Semester

**AUTOMOBILE ENGINEERING**

U18AUE0001: Design of Engine Components

**COURSE OUTCOMES**

- CO1:** Understand the design procedure for piston and cylinder  
**CO2:** Apply the design assumption in validating the types of connecting rod used in IC engines.  
**CO3:** Calculate the parameters required for designing the crankshaft  
**CO4:** Understand the steps involved in designing of different types of automotive clutch  
**CO5:** Apply the assumption and design valves and valve train  
**CO6:** Explain design methods for engine components

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-**

**PART A (10 x 2 = 20 Marks)**

**(Answer not more than 40 words)**

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|--|-----|------|
| 1. Mention the functions of piston rings   | CO1 | [K1] |
| 2. List out the significance of cylinder in an IC engine.                                    | CO1 | [K1] |
| 3. Can you provide the reason why the connecting rod shank portion is made of I section?     | CO2 | [K4] |
| 4. List out the forces acting on the connecting rod?   | CO2 | [K1] |
| 5. Distinguish between Centre crankshaft and overhung crankshaft.                            | CO3 | [K4] |
| 6. At what angle of the crank, the twisting moment is maximum in the crankshaft?             | CO3 | [K4] |
| 7. Why it is necessary to dissipate the heat generated when clutches operate?                | CO4 | [K2] |
| 8. Establish a formula for the frictional torque transmitted by a cone clutch.               | CO4 | [K1] |
| 9. Name the material is used for the inlet and exhaust valves                                | CO5 | [K1] |
| 10. Why the area of the inlet valve port is made larger than the area of exhaust valve port? | CO5 | [K2] |

**Answer any FIVE Questions:-**

**PART B (5 x 16 = 80 Marks)**

**(Answer not more than 400 words)**

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|---|-----|------|
| 11. a) A four stroke diesel engine has the following specifications :                                     | CO1 | [K3] |
| Brake power = 5 kW ; Speed = 1200 r.p.m. ; Indicated mean effective pressure = 0.35 N / mm <sup>2</sup> ; |     |      |
| Mechanical efficiency = 80 %.   |     |      |

Determine : 1. bore and length of the cylinder ; 2. thickness of the cylinder head ; and 3. size of studs for the cylinder head.

- b) Design a cast iron piston for a single acting four stroke engine for the following data; CO1 [K3]

Cylinder bore = 100mm;

Stroke = 125mm

Speed = 2000 rpm;

Maximum gas pressure = 5 MPa;

Mechanical Efficiency = 80%,

SFC = 0.15kg per brake power per hour;

Higher calorific value of fuel =  $42 \times 10^3$  kJ/kg;

Indicated Mean Effective Pressure = 0.75MPa

12. a) Determine the dimensions of cross-section of the connecting rod for a diesel engine with the following data: CO2 [K5]

Cylinder bore = 100 mm,

Length of connecting rod = 350 mm,

Maximum gas pressure = 4 MPa,

Factor of safety = 6.

- b) The connecting rod of a petrol engine at 1800 rpm and developing a maximum pressure of 3.15 bar. The diameter of the piston is 100 mm. Mass of the reciprocating parts per cylinder is 2.25 kg. Length of the connecting rod = 380 mm. Stroke of the engine is 190 mm. Compression ratio of the engine is 6:1. Take the factor of safety as 6. Take the length to diameter ratio for the big end bearing as 1.3 and the small end bearing as 2 and the corresponding bearing pressures as  $10 \text{ N/mm}^2$  and  $15 \text{ N/mm}^2$ . The density of the material of the rod may be taken as  $8000 \text{ kg/m}^3$ . Design the connecting rod for the I Section alone. Mark your designed dimensions in sketch. CO2 [K5]

13. a) Design a plain carbon steel centre crankshaft when the crank top dead centre for a single acting four stroke single cylinder engine for the following data: CO3 [K3]

Cylinder bore = 400mm: stroke = 600mm; speed = 2000rpm; Mean effective

Pressure = 0.5MPa Maximum gas pressure = 2.5 MPa ; Weight of the flywheel used as a pulley = 50kN; Total belt pull = 6.5kN.

- b) Explain the step by step design procedure for overhung type engine crankshaft when the crank is at dead centre with a sketch. CO3 [K2]
14. a) A single dry plate clutch is to be designed to transmit 7.5 kW at 900 r.p.m. CO4 [K5]  
Find, 1. Diameter of the shaft,  
2. Mean radius and face width of the friction lining assuming the ratio of the mean radius to the face width as 4,  
3. Outer and inner radii of the clutch plate, and  
4. Dimensions of the spring, assuming that the number of springs are 6 and spring index = 6. The allowable shear stress for the spring wire may be taken as 420 MPa.
- b) A centrifugal clutch is to be designed to transmit 15 kW at 900 r.p.m. The shoes are four in number. The speed at which the engagement begins is 3/4th of the running speed. The inside radius of the pulley rim is 150 mm. The shoes are lined with Ferrodo for which the coefficient of friction may be taken as 0.25. Determine: 1. mass of the shoes, and 2. size of the shoes CO4 [K5]
15. a) The conical valve of an IC engine is 60mm in diameter and is subjected to a maximum gas pressure of 4 N/mm<sup>2</sup>. The safe stress in bending for the material is 46MPa. The valve is made of steel for which K =0.42. The angle at which the valve disc seat is tapered is 30° Determine CO5 [K5]  
i. Thickness of the valve head  
ii. Stem diameter and  
iii. Maximum lifts of the valve.
- b) Design a close coiled helical compression spring for a service load ranging from 2250N to 2750N. The axial deflection of the spring for the load range is 6mm. Assume a spring index of 5. Their permissible shear stress intensity is 420MPa and modulus of rigidity as 84 kN/mm<sup>2</sup>. CO5 [K5]
16. a) Explain the step by step design procedure for cone clutch with a sketch. CO6 [K6]  
b) Write the design procedure for design of rocker arm with a neat sketch. CO6 [K6]

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