KUMARAGURU
college of technology
character is life

B.E DEGREE EXAMINATIONS: APRIL /MAY 2024

(Regulation 2018)

Sixth Semester

AUTOMOBILE ENGINEERING

U18AUE0001**:** Design of Engine Components

(Use of Approved Data Book Permitted)

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)

1.	Classify S.I Engines with C.I engines based on design.	CO1	[K_2]
2.	Identify the principal parts of I.C engines.	CO1	[K_2]
3.	Name the two types of stress acting in the Engine cylinder walls.	CO2	[K_2]
4.	Infer the design consideration of piston.	CO2	[K_2]
5.	Analyze the conditions where piston slap can occur.	CO3	[K_2]
6.	Illustrate about the forces acting on connecting rod.	CO3	[K_2]
7.	Summarize the role of crankshaft and its types.	CO4	[K_2]
8.	Discuss shortly on Positive clutch.	CO4	[K_2]
9.	Classify different types of valves used in I.C. Engines.	CO5	[K_2]
10.	List out the main components of valve gear mechanism.	CO6	[K_2]

Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)

11. a) Formulate the equation to design Engine cylinder components such as: 8   CO1   [K₂]

   - Wall Thickness
   - Bore length.
   - Cylinder flange and stud.
   - Cylinder head.

   b) A four-stroke diesel engine has the following specifications: 8   CO2   [K₃]

   Brake power = 5 kW; Speed = 1200 r.p.m. Indicated mean effective pressure =

   0.35 N / mm ^{2} Mechanical efficiency = 80 %.

   Determine:

   1. bore and length of the cylinder

   2. thickness of the cylinder head

   3. size of studs for the cylinder head.

12. a) Draw a neat sketch of piston and mark all the parts along with the design   8   CO2   [K₂]
   equation.

   b) Design a cast iron piston for a single acting four stroke engine for the following.   8   CO2   [K₃]
   data:

   Cylinder bore = 100 mm; Stroke = 125 mm ; Maximum gas pressure = 5
   N/mm2 ; Indicated mean effective pressure = 0.75 N/mm2 ; Mechanical
   efficiency = 80% ; Fuel consumption = 0.15 kg per brake power per hour ;
   Higher calorific value of fuel = 42 × 103 kJ/kg ; Speed = 2000 r.p.m.

   Any other data required for the design may be assumed.

13. Design a connecting rod for an I.C. engine running at 1800 r.p.m. and developing   16   CO3   [K₃]
   a maximum pressure of 3.15 N/mm². The diameter of the piston is 100 mm ;
   mass of the reciprocating parts per cylinder 2.25 kg; length of connecting rod 380
   mm; stroke of piston 190 mm and compression ratio 6 : 1. Take a factor of safety
   of 6 for the design. Take length to diameter ratio for big end bearing as 1.3 and
   small end bearing as 2 and the corresponding bearing pressures as 10 N/mm² and

15 N/mm^2. The density of material of the rod may be taken as 8000 kg/m^3 and the allowable stress in the bolts as 60 N/mm^2 and in cap as 80 N/mm^2. The rod is to be of I-section for which you can choose your own proportions. Draw a neat, dimensioned sketch showing provision for lubrication. Use Rankine formula for which the numerator constant may be taken as 320 N/mm^2 and the denominator constant 1 / 7500.

14.	Discuss the design procedure for center crankshaft when the crank is at dead center.	16	CO4	[K$_2$]

15.	a)	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/mm^2; 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.	8	CO5	[K$_3$]
	b)	Discuss about the design consideration of friction clutch and Materials used in friction surfaces of clutch.	8	CO5	[K$_2$]

16.	a)	Discuss about valves and derive the equation to calculate the following:
		  i. Size of valve port
		  ii. Thickness of valve disk
		  iii. Maximum lift of valve.
		Apply the above equation to design the conical valve of an I.C. engine is 60 mm in diameter and is subjected to a maximum gas pressure of 4 N/mm^2. The safe stress in bending for the valve material is 46 MPa. The valve is made of steel for which k = 0.42. The angle at which the valve disc seat is tapered is 30°.
			8	CO6	[K$_3$]

	b)	Discuss in detail of the steps involved in the design of rocker arm.	8	CO6	[K$_2$]

****