



**B.E DEGREE EXAMINATIONS: APRIL/MAY 2016**

(Regulation 2013)

Sixth Semester

**AUTOMOBILE ENGINEERING**

U13AUT602 : Engine Design

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-**

**PART A (10 x 1 = 10 Marks)**

1. The engine cylinder is made of
  - a) Grey cast iron
  - b) Cast steel
  - c) Medium Carbon steel
  - d) Aluminum
2. To maintain a seal between the piston and inner wall of the cylinder, ----- are employed
3. In 4 stroke engines, the connecting rod is subjected to variable loading, changing from
  - a) Compression to tension
  - b) Zero to tension
  - c) Zero to compression
  - d) Tension to compression
4. Connecting rod is connected to piston through .....
5. Crankshaft is made of
  - a) Grey cast iron
  - b) Cast steel
  - c) Medium Carbon steel
  - d) Aluminum
6. The typical firing order of Inline four cylinder engine is .....
7. A multi disc clutch has three discs on the driving shaft ( $n_1$ ) and two discs on the driven shafts ( $n_2$ ).  
Number of pairs of contact surfaces is
  - a) 2
  - b) 3
  - c) 4
  - d) 5
8. A jaw clutch is .....
9. To increase volumetric efficiency of engines
  - a) Inlet valve size is reduced
  - b) Exhaust valve size can be increased
  - c) Multiple number of exhaust valves provided
  - d) Inlet valve size is increased
10. Inlet valve is generally made of .....

**PART B (10 x 2 = 20 Marks)**  
**(Answer not more than 40 words)**

11. Classify the IC engine based on cylinder arrangement?
12. What are the parameters to be considered while choosing material for cylinder and liner?
13. What is the application of connecting rod?
14. Name the materials used for diesel engine connecting rod?
15. Name the two different types of crankshaft and explain?
16. Name the materials used for engine crank shaft?
17. Classify and describe the friction clutches?
18. What are the characteristics of good friction materials used in clutches?
19. Sketch a valve gear mechanism of an internal combustion engine?
20. Why the area of the inlet valve port is made larger than the area of exhaust valve port?

**PART C (5 x 14 = 70 Marks)**  
**(Answer not more than 400 words)**

**Q.No. 21 is Compulsory**

21. Design a rocker arm, and its bearings, tappet, roller and valve spring for the exhaust valve of a four stroke I.C. engine from the following data:  
Diameter of the valve head = 80 mm; Lift of the valve = 25 mm; Mass of associated parts with the valve = 0.4 kg; Angle of action of camshaft =  $110^\circ$ ; R.P.M. of the crankshaft = 1500.  
From the probable indicator diagram, it has been observed that the greatest back pressure when the exhaust valve opens is  $0.4 \text{ N/mm}^2$  and the greatest suction pressure is  $0.02 \text{ N/mm}^2$  below atmosphere.  
The rocker arm is to be of I-section and the effective length of each arm may be taken as 180 mm; the angle between the two arms being  $135^\circ$ .  
The motion of the valve may be assumed S.H.M., without dwell in fully open position.  
Choose your own materials and suitable values for the stresses.  
Draw fully dimensioned sketches of the valve gear.

22. (a) (i) Design a cast iron piston for a 4 stroke I.C Engine with the following specifications (10)  
Cylinder bore = 100 mm  
Stroke length = 120 mm  
Maximum gas pressure =  $4 \text{ N/mm}^2$   
Indicated mean effective pressure =  $0.75 \text{ N/mm}^2$   
Mechanical efficiency = 80%  
Fuel consumption = 0.15 kg per BHP hour  
Calorific value = 42000 kJ/kg  
Speed = 2000 rpm. Assume any other relevant data required  
(ii) What is the purpose of piston rings and classify them (4)

**(OR)**

- (b) (i) Design a cast iron cylinder for an I.C Engine whose bore diameter is 80 mm and the max combustion pressure is 5.5 MPa (7)
- (ii) Briefly discuss the parameters to be considered when designing a piston? (7)
23. (a) (i) Discuss the various steps involved in design of crankshaft? (7)
- (ii) Explain the design of single throw crank shaft (7)
- (OR)**
- (b) (i) Design an overhung crank shaft for the following data. (10)
- Maximum load on the crank pin for the maximum torque position =50 KN.  
Crank radius =200 mm. Distance between crank pin centre and nearby bearing centre=300 mm. Allowable stress in bending= 70 MPa shear = 50 MPa, bearing =7 MPa
- (ii) Describe the stresses induced in the crank shaft journal (4)
24. (a) (i) Describe the steps followed in designing disc clutches (7)
- (ii) A multiple clutch is to be designed to transmit power of 50 kW at 500 rpm. Assuming suitable materials and data, determine the main dimensions of friction lining used in that clutch. (7)
- (OR)**
- (b) (i) Briefly describe the working principle of multiple disc clutch with neat sketch (7)
- (ii) A cone clutch transmits 5 kW power at 240 rpm .the smaller radius of the cone is 200 mm and the face width is 50 mm. The cone has a face angle of 15°. Determine the axial force necessary to engage the clutch, if the coefficient of friction at the contact surfaces is 0.25. Also determine the maximum pressure on the contact surfaces, assuming uniform wear (7)
25. (a) (i) Design the I section connection rod for a single cylinder IC engine using the following specifications (10)
- Diameter of the piston=100 mm, Mass of reciprocating parts=2.25 kg  
Length of connecting rod =300 mm, Stroke length =125 mm  
Speed =1500 rpm, Maximum explosion pressure = 3.5 N/mm<sup>2</sup>  
Compression ratio -6,Factor of safety =7  
Density of rod material =8000 kg/m<sup>3</sup>,  
Yield stress in compression = 330 MPa
- (ii) What are the various forces acting on the connecting rod? (4)

**(OR)**

- (b) (i) Explain the method of designing connecting rod and explain why I-section is preferred for the connecting rod. (7)
- (ii) Derive the expression force on the piston due to gas pressure and inertia of reciprocating parts. (7)

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