**DEPARTMENT OF MECHANICAL ENGINEERING**

**ME2301 THERMAL ENGINEERING**

**Question Bank**

**Unit-I**

**Part-A**

1. Define compression ratio.
2. Sketch the Otto cycle on P-V and T-S planes.
3. Draw the P-V and T-S diagram of Diesel cycle.
4. Write the formula to find the air standard efficiency of Otto cycle.
5. Write the formula to find the air standard efficiency of Diesel cycle.
6. What is mean effective pressure?
7. What is air standard efficiency?
8. What is cut-off ratio?
9. What is the effect of cut-off ratio in diesel cycle?
10. Draw the P-V and T-S diagram of Dual cycle.
11. Draw the P-V and T-S diagram of Brayton cycle.
12. Write the formula to find the air standard efficiency of Brayton cycle.
13. Write the formula to find the air standard efficiency of Dual cycle.
14. What is Relative efficiency?
15. What is swept volume?
16. What is clearance volume?
17. Which cycle is called as mixed cycle or limited pressure cycle?
18. What is expansion ratio?
19. What is an air standard cycle?
20. In an Otto cycle, pressure ratio during compression is 11. Calculate the air standard efficiency.

**PART-B**

1. Derive an expression to find the air standard efficiency and mean effective pressure of Otto cycle.
2. A four stroke engine having a swept volume of 0.4 m3 operates on Otto cycle. The compression ratio is 6. The temperature and pressure at the beginning of compression are 1 bar and 60°C. The heat supplied is 150 KJ/cycle. Calculate (a) pressure and temperature at cardinal points, (b) work done, (c) efficiency, and (d) mean effective pressure.
3. Derive an expression to find the air standard efficiency and mean effective pressure of Diesel cycle.
4. An oil engine with 20 cm cylinder diameter and 30 cm stroke works on theoretical Diesel engine. The initial pressure and temperature of the air used are 1 bar and 30°C. The cut-off is 10% of the stroke. Find the following:
5. Pressure and temperature at all salient points.
6. Theoretical air standard efficiency.
7. Mean effective pressure.
8. The power developed by the engine if the working cycles per minute are 400.

Assume the compression ratio is 16 and working fluid is air. Take all ideal conditions.

1. Derive an expression to find the air standard efficiency and mean effective pressure of Dual- Cycle.

6. An engine working on Dual cycle has a compression ratio 12. The pressure and temperature at the beginning of compression are 1 bar and 27° C. The peak pressure is 70 bar. Heat is added during constant pressure process up to 3% of the stroke. Taking cylinder diameter as 25 cm and stroke 30 cm, calculate (a) the pressure and temperature at the cardinal points of the cycle, (b) Air standard efficiency (c) mean effective pressure.

7. An oil engine works on the dual cycle. The compression ratio is 10 and expansion ratio is 5.5. The initial pressure and temperature of the air are 1 bar and 300 K. The heat liberated at constant pressure is twice the heat liberated at constant volume.The expansion and compression follow the law pv1.3 =C. Find the following:

(a) Pressure and temperature at all salient points.

(b) Mean effective pressure

(c) Efficiency of the cycle. And

(d) The power developed if working cycles are 500/min and d=24 cm and L= 40 cm.

8. The compression ratio of a Diesel cycle is 16. The initial pressure and temperature are 1 bar and 300 K. The heat added is 1500 KJ/kg. Find (a) Fuel cut-off ratio (b) Pressure and temperature at the end of expansion (c) Thermal efficiency of the cycle (d) Mean effective pressure and (e) Power developed if the mass of air used is 6 kg/min.

9. A gas turbine works on Brayton cycle. The initial condition of the air is 1 bar and 25° C. The maximum pressure and temperature is 3 bar and 660° C. Calculate (a) Cycle efficiency, (b) Heat supplied and heat rejected per kg of air, (c) work done per kg of air, and (d) exhaust temperature.

10. The pressure and temperature at the beginning in an air standard Brayton cycle are 100 Kpa and 27°C . The heat added per kg of air is 1850 KJ.The compression ratio is 4. Determine the maximum pressure and temperature, thermal efficiency and mean effective pressure. Assume γ =1.4, Cp= 1.005KJ/kg.K.

**Unit-II**

**Part-A**

1. 1.What is an internal combustion engine?
2. Name any five parts of Internal combustion engine.
3. What are the different types of engine cooling methods?
4. What are the functions of lubrication?
5. What are the desirable properties of lubricating oil?
6. Define specific fuel consumption.
7. What is Brake power?
8. What is SIP?
9. What is the use of transfer port in two stroke engines?
10. Name the four strokes of a four stroke engine.
11. What is valve timing diagram?
12. What is port timing diagram?
13. What is the range of compression ratio for Diesel engine?
14. What is the range of compression ratio for petrol engine?
15. Write the firing order of four cylinder engine.
16. Name some emissions comes out from Diesel engine.
17. What is Brake thermal efficiency?
18. What is Heat balance sheet?
19. What is mechanical efficiency?
20. What is frictional power?

**Part-B**

1. (i) Define I.C.engine. How are these engines classified.

(ii) What are the main differences between 4- stroke and 2- stroke engines?

2. (i) Describe the working principle of a four- stroke cycle petrol engine and draw its

valve timing diagram.

(ii) Describe the working principle of a four- stroke cycle Diesel engine and draw its valve timing diagram.

1. (i) Describe the working of two stroke cycle petrol engine.

(ii) Describe the working of two stroke cycle Diesel engine.

1. (i) What are the advantages and disadvantages of a two stroke cycle engine over a four stroke cycle engine?

(ii) What are the differences between a petrol engine and a Diesel engine?

1. (i) Draw the circuit diagram and describe the working of battery ignition system used for a four-cylinder petrol engine.

(ii) Draw the circuit diagram and describe the working of Magneto ignition system used for a four-cylinder petrol engine.

6. (i) What is the purpose of cooling I.C.engine? Describe the water cooling system. What are its advantages and disadvantages?

(ii) Describe with neat sketches the working of fuel injector used in diesel engine.

7. The following particulars refer to a 2 stroke diesel engine:

* + 1. Bore=10 cm, stroke=15 cm, piston speed= 300 m/min, torque developed=58Nm, mechanical efficiency=80%, indicated thermal efficiency=40%, calorific value of fuel used=44000KJ/kg. Determine: (a) indicate power, (b) indicated mean effective pressure, and (c) fuel consumption per KW hour on brake power basis.

8. A two stroke cycle, 21cmx 28cm stroke, single cylinder oil engine gives the following

results on test:

Speed =350 r.p.m

Net brake load =620 N

Diameter of brake drum =1m

Oil consumption =4.25 kg/hr.

I.m.e.p. =275 KN/m2

Heating value of fuel used =43000KJ/kg.

Air- fuel ratio by weight =32

Temperature of air in test room =20° C

Temperature of exhaust gases =370°C

Calculate (a) the indicated power, (b) the brake power, (c) indicated thermal efficiency,(d) Brake thermal efficiency, and (e) percent heat loss to exhaust gases. Assume a mean Cp of 1 for the exhaust gases.

9. A 4- cylinder, 4- stroke petrol engine 6 cm bore and 9 cm stroke was tested at constant speed. The fuel supply was fixed to 0.13 kg/min, and plugs of 4- cylinders were successively short-circuited without change of speed.

1. The power- measurements were as follows:
2. With all cylinders working= 16.25KW, With No. 1st cylinder cut off= 11.55KWh(B.P), With No. 1st cylinder cut off= 11.55KWh(B.P.) , With No. 2nd cylinder cut off= 11.65KWh (B.P.) , With No. 3rd cylinder cut off= 11.70KWh (B.P.), With No. 1st cylinder cut off= 11.50KWh(B.P.)
3. Find (a) The I.P. of the engines
4. (b) The mechanical efficiency
5. (c) Indicated thermal efficiency if C.V. of fuel used is 42,000 KJ/kg and
6. (d) Also find the relative efficiency on I.P. basis assuming clearance volumes 65 cu. Cm.
   * + 1. A test on single cylinder, 4- stroke oil engine, having bore 180 mm and stroke 360 mm gave the following results: speed 290 r.p.m.; brake torque 392 Nm ; indicated mean- effective pressure 7.2 bar; oil consumption 3.5 kg/hr; cooling water flow 270 kg/hr; cooling water temperature rise 36°C; air- fuel ratio by mass 25; exhaust gas temperature 415°C; barometric pressure 1.013 bar; room temperature 21°C. The fuel has calorific value of 45, 200KJ/kg and contains 15% of hydrogen by mass. Calculate:
   1. the indicated thermal efficiency, and
   2. the volumetric efficiency based on atmospheric conditions.
      1. Draw up a heat balance sheet in terms of KJ/min. Take R= 0.287KJ/kg°C, Cp for dry exhaust gases= 1.0035 KJ/kg-K and Cps for superheated steam= 2.093KJ/kg-K.
7. Discuss about the combustion chambers in Petrol engine.
8. Discuss about the combustion chambers employs in Diesel engine.