Question Bank

Sub: Applied Thermodynamics-II Class: B.Tech., Sem-VI
Subject code: BTMEC603 Academic Year: 2021-22

Que	Description
1.	Classify IC Engines on the basis of number strokes, thermodynamic cycle, cooling method. Draw a valve timing diagram for a typical four-stroke petrol engine. Compare SI engines with CI engines.
2.	Compare 4-stroke and 2-stroke cycle engines. Explain, why vehicular 2-stroke petrol engines are obsolete/discontinued from use.
3.	Draw valve timing diagram for a typical 4-stroke Petrol engine. Explain, what is valve overlap.
4.	Oil engine working on Diesel cycle has a compression ratio of 14. The fuel cut-off takes place at 8% of stroke. Calculate cut-off ratio and diesel cycle efficiency. State the assumptions made, if any.
5.	Draw p-θ diagram of normal combustion in CI engine. Also draw a neat labelled diagram of pre-combustion chamber & write its merits.
6.	Draw p-θ diagram of normal combustion in SI engine. Discuss types of combustion chambers used for SI engines
7.	Define Octane number & Cetane number with reference to rating of IC engine fuels. Differentiate between knocking in CI engine vs Detonation in SI engine.
8.	Draw a neat labelled diagram of typical water-cooled system used in four-cylinder engine.
9.	Draw a neat and labelled diagram of wet sump lubrication system with pressure/force feed. Which type of pump is used in the system for circulation of oil?
10.	The pressure and temperature of a Diesel cycle at the beginning of compression are 1 bar and 17^{o}C respectively. The pressure at the end of compression is 40 bar and that at the end of expansion is 2 bar. Assume adiabatic index as 1.4. Calculate: 1) pressure and temperature at all corners of the cycle 2) cycle efficiency 3) cut-off ratio
11.	Derive equation for an efficiency of Otto cycle. In an Otto cycle, air at 1 bar and 17^{o}C is compressed adiabatically to 15 bar. The heat is then added at constant volume till pressure rises to 40 bar. Calculate: 1) pressure and temperature at all the corners in the cycle 2) efficiency of Otto cycle 3) compression ratio.
12.	Draw circuit diagram of a coil/battery ignition system. Write functions of its important components.
13.	Draw circuit diagram of magneto ignition system. Write functions of its important components.

14.	Draw a diagram for comparing fuel-air cycle with actual cycle. Show various loses in the diagram.
15.	Explain, centrifugal type quality governing system used in SI engines, with the help of a neat and labelled diagram.
16.	Explain energy/heat balance sheet used for studying performance of IC engine. Write down equations used for calculation of each component of energy supplied to & utilized in an engine.
17.	Explain 'Morse test'. Where it is used? A petrol engine working on 4-stokes develops a brake power of 20.9 kW. A Morse test was conducted on engine by short circuiting the spark plugs one-by-one. Following four readings were obtained during the test: **Sequence of short circuiting of spark plugs** / **Corresponding brake power, kW** 1^{st} cylinder — 14.9 2^{nd} cylinder — 14.3 3^{rd} cylinder — 14.8 4^{th} cylinder — 14.5 During the test engine speed was maintained at 3000 rpm. The engine has 75 mm bore and 90 mm stroke. Calculate following parameters when all cylinders are firing: • Indicated power (IP) • Mechanical efficiency • Brake-mean-effective-pressure (BMEP)
18.	What is turbocharging? Explain it with the help of a simple diagram. What are benefits of supercharging in CI engine.
19.	Explain the catalytic convertor used in IC engine. Discuss various types of alternative fuels used for SI & CI engines in India.
20.	A simple saturation vapour compression cycle of refrigeration using R-22 is designed for a cooling load of 10 TR. The saturation suction and discharge temperatures are 5^oC and 40^oC respectively. Calculate **(12)** 1. Temperature at the end of isentropic compression 2. Mass flowrate of refrigerant 3. COP 4. Compressor power in kW 5. Heat rejected by refrigerant in the condenser. Use following properties of R-22 **t** ^oC / **p** bar / **h_f** kJ/kg / **h_g** kJ/kg / **s_f** kJ/kg K / **s_g** kJ/kg K / **v_g** m^3/kg 5 / 5.836 / 205.9 / 407.1 / 1.02115 / 1.7447 / 0.0404 40 / 15.331 / 249.53 / 416.4 / 1.16659 / 1.6995 / -

21.	Discuss the desirable properties of refrigerants used in vapour compression refrigeration systems.
22.	Explain a simple vapour absorption system of refrigeration using a neat sketch. What are its advantages/dis-advantages in comparison with vapour compression system of refrigeration?
23.	Show vapour compression cycle of refrigeration on T-s & h-s diagrams.
24.	Draw and explain Bell-Coleman cycle of air refrigeration on T-s and P-v diagrams.
25.	What are applications of air conditioning? Distinguish between comfort air conditioning and industrial air conditioning.
26.	Explain following terms: 1) DBT 2) WBT 3) DPT 4) specific humidity 5) relative humidity 6) saturated air
27.	What is psychrometric chart? Show various processes on it (which are normally used in air conditioning)
28.	Draw a schematic of a typical wind turbine for power generation and label its components. Write functions of its main components.
29.	Draw a schematic diagram of ideal regenerative steam power plant with single open type feed-water heater. Also, represent the corresponding cycle on T-s diagram**.**
30.	Draw a schematic diagram of re-heat type steam power plant with single reheater. Also, represent the corresponding cycle on T-s diagram**.**
32.	Write a short note on: 1) combined cycle power plant 2) co-generation type power plant (use schematic diagram and T-s diagram to explain them)
31.	Calculate efficiency and specific work output of simple gas turbine power plant operating on Brayton cycle. The maximum and minimum temperatures are 1300K and 300K, respectively. The compressor pressure ratio is 6. Assume $\eta_c = 1$, $\eta_t = 1$ and neglect the pressure losses during combustion.
32.	Consider a steam power plant operating on simple ideal Rankine cycle. Steam enters the turbine at boiler pressure of 150 bar and temperature 400°C and is condensed in the condenser at the pressure 0.1 bar. Assume isentropic efficiency of the turbine as 100%. Determine: a) Net work done. b) Specific steam Consumption. c) Thermal efficiency considering pump work
33.	Consider a steam power plant operating on simple ideal Rankine cycle. Dry saturated steam enters the turbine at boiler pressure of 30 bar and is condensed in the condenser at the pressure 0.02 bar. Assume isentropic efficiency of the turbine as 100%. Determine: a) Net work done. b) Specific steam Consumption. c) Thermal efficiency considering pump work
34.	A simple Brayton cycle using air as a working fluid has a pressure ratio of 10. The minimum and the maximum temperature in the cycle are 295 K and 1240 K respectively. Assume an isentropic efficiency of compressor and turbine as 100%

	Determine: 1. Air temperature at compressor and turbine exit 2. The work ratio 3. Thermal efficiency of a Joule cycle
35.	Draw a schematic diagram and corresponding T-s diagram representing the Joule/Brayton cycle with simultaneous modifications incorporating intercooler, reheater and regenerator.
36.	Draw a schematic diagram of a typical modern steam power plant. Write down the guidelines for the selection of site for large steam power plant.
37.	Draw a schematic diagram of a typical hydro-electric power plant. Write down the guidelines for the selection of site for the power plant.
38.	Draw a schematic diagram of a typical open cycle GTPP. Write down the guidelines for the selection of site for this type of power plant.
39.	Draw a schematic diagram of a typical nuclear power plant. Write down the guidelines for the selection of site for this type of power plant.
40.	Write a note on 1) types of nuclear reactors 2) nuclear fuels 3) safety requirement in nuclear PP 4) typical plant layout of diesel power plant.

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