WINTER – 2022 EXAMINATION

Model Answer

Subject Name: Power Engineering & Refrigeration **Subject Code:** 22562

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.
8) As per the policy decision of Maharashtra State Government, teaching in English/Marathi and Bilingual (English + Marathi) medium is introduced at first year of AICTE diploma Programme from academic year 2021-2022. Hence if the students in first year (first and second semesters) write answers in Marathi or bilingual language (English +Marathi), the Examiner shall consider the same and assess the answer based on matching of concepts with model answer.

Q. No.	Sub Q. N.	Answer	Marking Scheme
1.		**Attempt any FIVE of the following:**	**10**
	a)	**Define : i)Indicating Power ii) Octane Number**	**2 Marks**
	Sol.	**i) Indicated Power**: The total power developed by combustion of fuel in the combustion chamber is called indicated power.	1 mark
		ii) **Octane Number:** a number that is used to measure the antiknock properties of a liquid motor fuel (such as gasoline)	1 mark
	b)	**Name the components used in Vapour compression refrigeration Cycle**	**2 marks**
	Sol.	i) Compressor ii) Condenser iii) Capillary (Expansion device) iv) Evaporator	**½ mark for each component**

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1.	**c)**	**Define BSFC and state its unit.**	
	Sol.	Brake specific fuel consumption is the ratio of a mass flow rate of the fuel supplied to the engine to the brake power obtained at a crankshaft and it indicates how efficiently the fuel is used to produce brake power. BSFC = Mass flow rate of fuel (m)/ BP	**2 marks**
	d)	**Define the term FAD**	
	Sol.	Actual volume of the air delivered by the compressor when reduced to normal temperature and pressure is known as Free air delivered (FAD) OR Free air delivery (FAD) is the enlarged volume of air that the compressor releases into the network within a given measure of time	**2 marks**
	e)	**State any two application of gas turbine .**	
	Sol.	1. It is used for electric power generation. 2. It is used for locomotive propulsion. 3. It is used for ship propulsion. 4. Gas turbine is used in aircrafts. 5. It is used for supercharging for heavy duty Diesel engines. 6. Used in turbo jet and turbo-propeller engine. 7. It is used for various industrial purpose such as in steel industry, oil and other chemical industry.	**2 Marks for any 2 application**
	f)	**Name the main components used in constant pressure cycle gas turbine.**	
	Sol.	Compressor Combustion Chember Turbine	**2 marks for Any 2**
	g)	**State any 2 advantages of “VVT-I”.** Reduce pumping losses.	

Smoother idle and low rpm running of engine.

Better torque and Increase fuel economy

Reduce the emission of Nitric oxide (NOx)

Controlling the cylinder temperature by valve overlap.

Better breathing of engine and Assist the scavenging process.

Increase engine life.

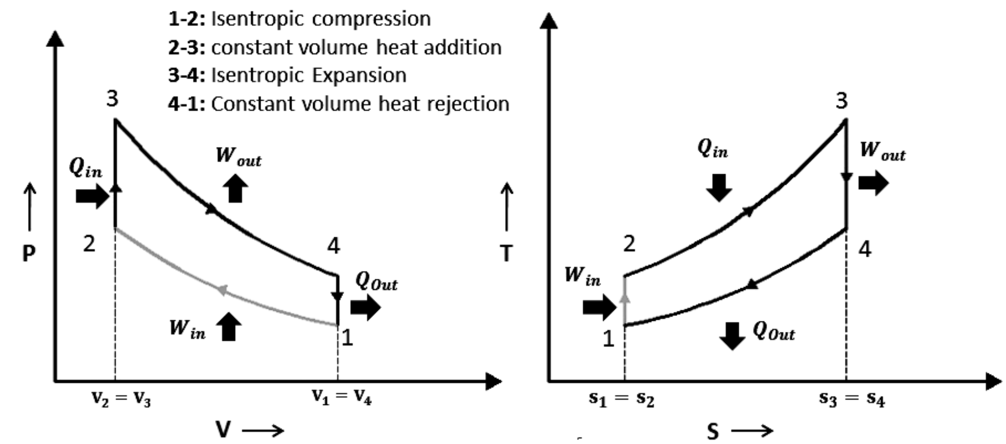
2 Marks

Any 2 Advantages

2. **Attempt any THREE of the following:** **12**

a) **Represent otto cycle on P-V & T-S diagram**

Sol.



1.5 Marks for PV diagram

1.5 Marks for TS Diagram

1 Mark for labeling

b) **State effect of compression ratio (Rc) on Air standard efficiency of i) Otto cycle ii) Diesel Cycle**

Sol.

According to thermodynamics, otto cycle & Diesel has its own P-V diagram and based on that diagram we can derive the efficiency equation. Now compression ratio is common term in all these cycle. Compression ratio is defined as the ratio of the total volume of the cylinder to the clearance volume of the engine. It is a fundamental specification for many common combustion engines.

Otto cycle

For Otto cycle the equation of efficiency is given by,

$$\eta = 1 - \left(\frac{1}{r^{(\gamma-1)}}\right)$$

2 Marks for equations

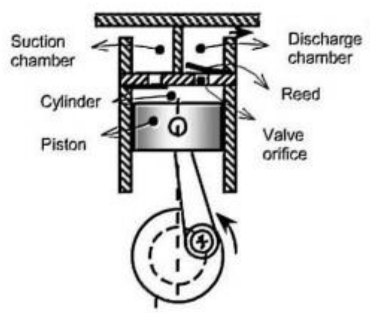
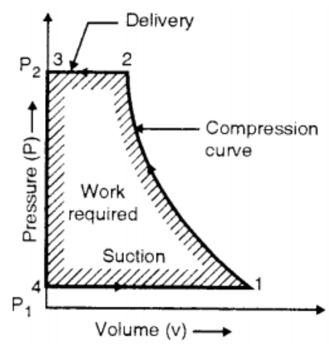
Diesel cycle

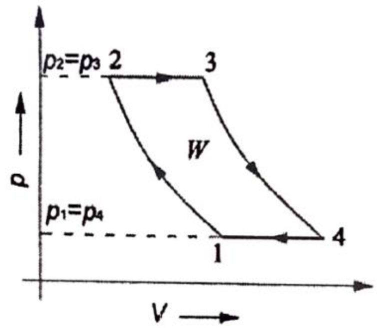
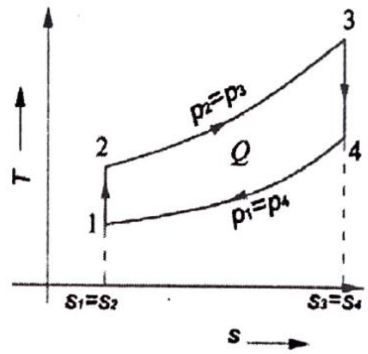
For Diesel cycle the equation of efficiency is given by,

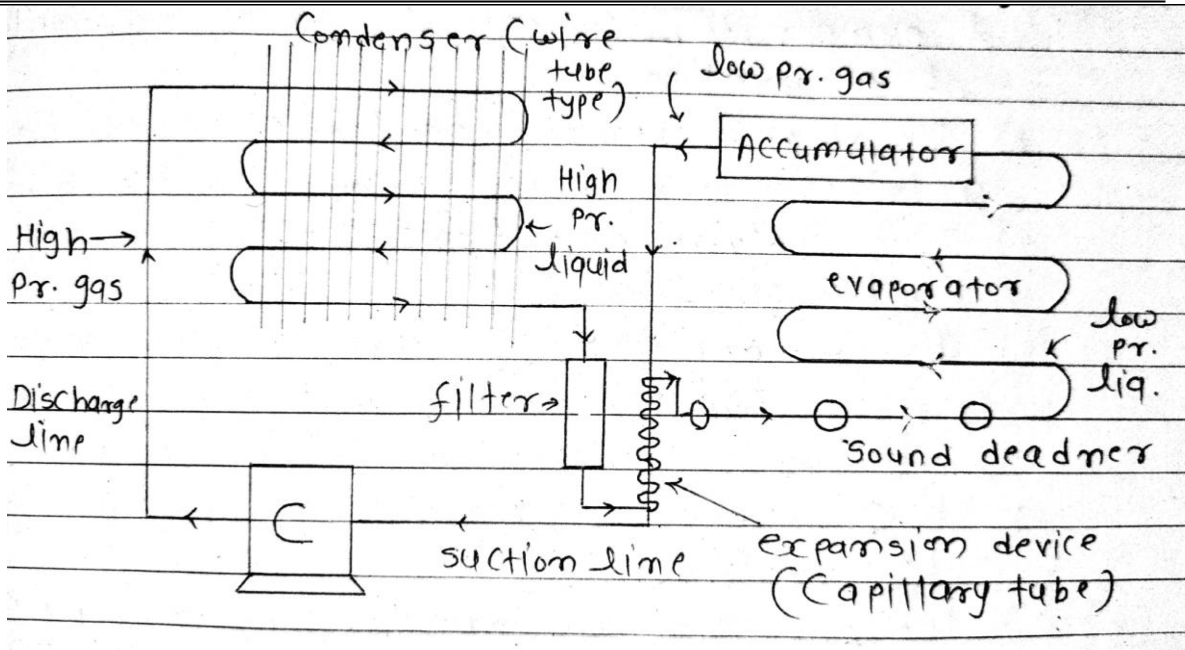
$$\eta_{th} = 1 - \frac{1}{r^{\gamma-1}}\left(\frac{\alpha^{\gamma}-1}{\gamma(\alpha-1)}\right)$$

2 marks for conclusion

Where r is compression ratio

		So you can see that in in above cases the efficiency equation contains, compression ratio term, so compression ratio is an important term in all three cases. Higher the compression ratio, higher the efficiency.	
2.	**c)** **sol.**	**Explain working of single stage single stage single acting compressor with neat sketch** **Working :** In a single-stage reciprocating compressor, all the compression process takes place in only one cylinder. Two valves connect with the cylinder, one is an inlet or suction valve, and the other is an outlet or delivery valve. The opening and closing of a spring or plate valve vary on the pressure difference. When mechanical valves use for suction and discharge, their function controls through cams.   When the piston reaches at BDC, the crankcase movement helps the piston to move upward and compresses the air. During this compression process, there is a point where the cylinder's internal pressure becomes higher than the external air pressure, and at this stage, the inlet valve closes. An outlet connects with a storage tank. As the compressed air pressure becomes higher than the storage tank pressure, the outlet valve opens, and compressed air is released. Therefore, this piston stroke is known as s "**Delivery Stroke**". This is a compression stroke of the single-stage air compressor. At the end of this stroke, the outlet valve opens, and the compressed air transfers to the the receiver. The piston moves at a very high speed inside the cylinder and continuously exerts a force on the cylinder. Due to this reason, the compressor life reduces. To avoid this, a slight curvature provides at the top of the cylinder.	**2 marks for explanatio n** **2 marks for Diagram**
2.	**d)**	**Represent joules cycle on p-v & T-s Diagram**	

		 p-V diagram  T-s diagram	**2 marks for P-V diagram & 2 Marks for T-S Diagram**
3		**Attempt Any <u>THREE</u> of the following.**	**12**
	A	**State advantages of CRDI system used in CI engine**. **Advantages Of CRDI** • Uniform circulation of fuel to each cylinder • Only one pump is sufficient for circulation of fuel • Variation of pump pressure affects all cylinder uniformly • The arrangement of system is simple and requires less maintenance	**1 Mark for each point**
	b	Explain the terms: 1) **Compression Ratio**: Compression ratio is ratio of total cylinder volume to clearance volume. 2) **B.S.F.C:** It is defined as the ratio of the mass of fuel consumed per hour for unit power output (Brake power). It is designated by BSFC It is parameter which decides the economics of power production from engine. $\text{Brake specific fuel consumption} = \frac{m_f \text{ in kg/hr}}{\text{B.P. in kW}}$	**2 Marks** **2 Marks**
	C	**Explain with neat sketch the working of Domestic Refrigerator.**	



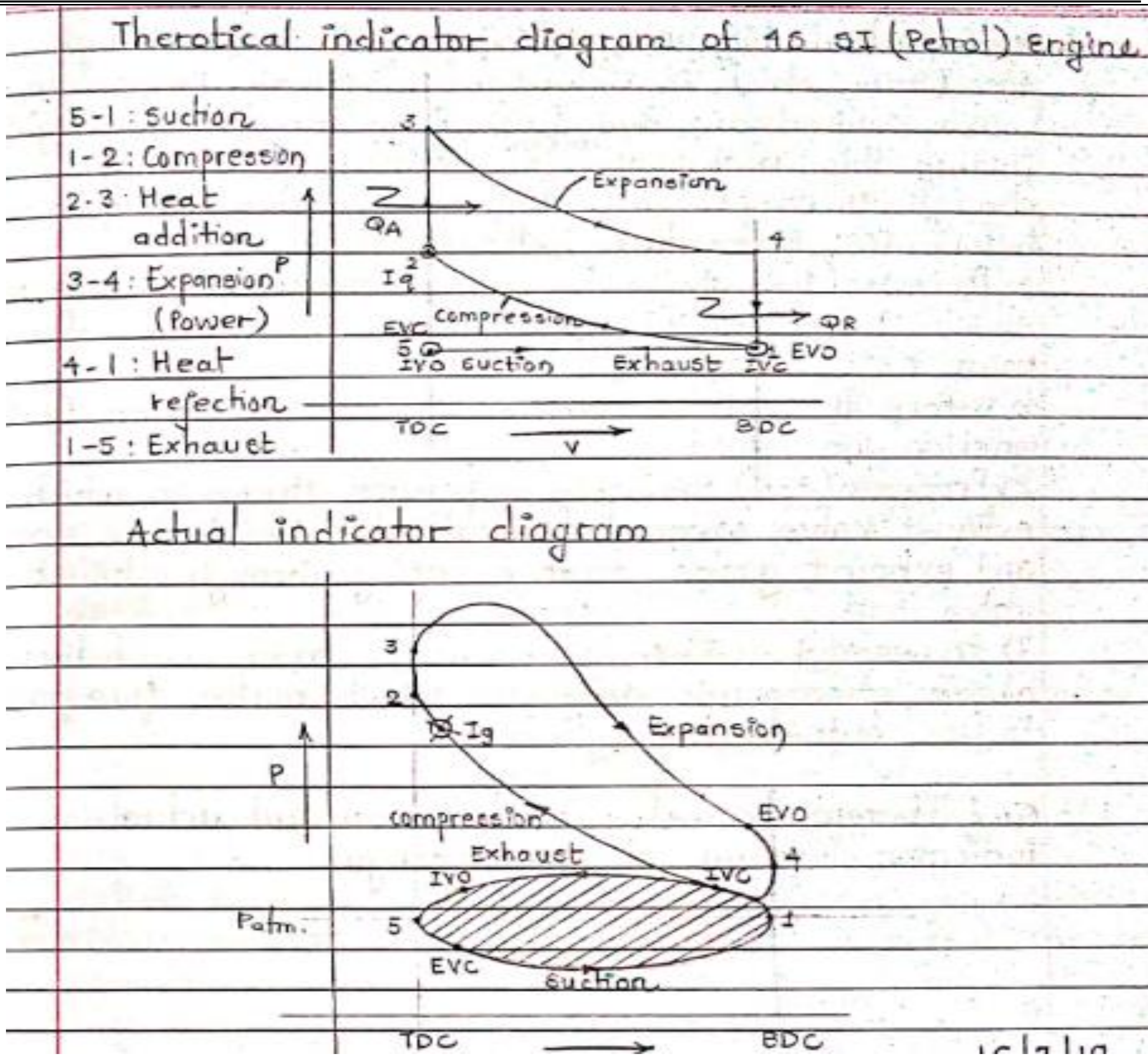
2 marks for Sketch

Working

- The low pressure and low temperature refrigerant vapour is sucked through the suction line to the compressor.
- The accumulator provided between the suction line and the evaporator collects liquid refrigerant out of the evaporator.
- The compressor then compresses the refrigerant vapour to a high pressure and high temperature.
- The refrigerant flows through the discharge line into condenser. In the condenser the vapour refrigerant at high pressure and at high temperature is condensed to the liquid refrigerant at high pressure and low temperature.
- The high pressure liquid refrigerant then flows through the filter and then enters the capillary tube (expansion device).
- The warm refrigerant passing through the capillary tube give some of its heat to cold suction line vapour as capillary coil is coiled around suction line.
- The capillary tube expands the liquid refrigerant at high pressure to the liquid refrigerant at low pressure & liquid refrigerant is passed into the evaporator.
- In the evaporator the liquid refrigerant gets evaporated by absorbing heat from the container/ articles placed in the evaporative chamber and is sucked back into the compressor and the cycle repeated.

2 Marks for working

D **Differentiate between theoretical Otto cycle and actual Otto cycle on PV Diagram**.



PV chart for Theoretical and Actual Otto cycle

3 Marks for PV chart(actual and theoretical)

Comparison between theoretical and actual Otto Cycle:

Above fig. shows both theoretical and actual PV chart for Otto Cycle

- In Theoretical Otto cycle it is observed that both suction and exhaust stroke take place at same pressure and opening and closing of valves is either at TDC or BDC
- In actual PV chart of Otto cycle suction take place at below atmospheric pressure. inlet valve open before TDC.
- In actual PV chart of Otto cycle inlet valve closes after BDC (at point 1)
- Ignition will start before end of compression stroke.
- Exhaust valve will open before BDC (i.e. before point 4)

Exhaust will take place above atmospheric pressure and exhaust will close after TDC.

1 mark for explanation

4		**Attempt any THREE of The Following**	**12**

4 A

Q.4 a)

Given : Four stroke engine

$D = 80\,mm = 0.080\,m$

$L = 200\,mm = 0.200\,m$

$P_m = 4.5\,bar = 4.5 \times 10^5\,Pa$

$= 4.5 \times 10^2 \times 10^3\,Pa$

$= 450\,KPa$

number of explosion per minute $= 420 = n$

Power available at shaft $= BP = 1.8\,KW$

To Find :— mechanical Efficiency $= \frac{B.P.}{I.P}$

sol^n :—

$$\text{Indicated power} = \frac{P_m \times A \times L \times n}{60}$$

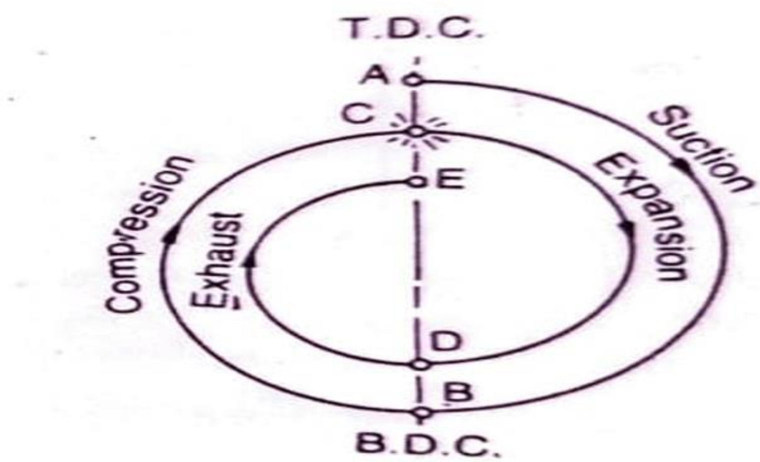
$$= \frac{450 \times 10^3 \times \frac{\pi}{4} \times (0.080)^2 \times 0.200 \times 420}{60}$$

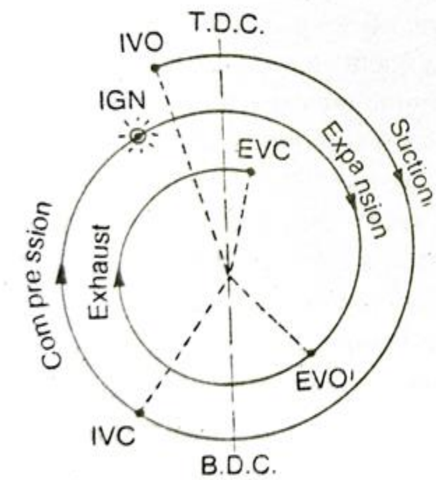
$$\boxed{IP = 3.166\,KW}$$ **2 Marks**

$$\eta_{mech} = \frac{1.8}{3.16} = 0.5696 \times 100$$

$$\boxed{\eta_{mech} = 56.96\,\%}$$ **2 Marks**

4 B **Draw the neat labeled valve timing diagram for four stroke petrol engine .**





TDC : Top dead centre

BDC : Bottom dead centre

IVO : Inlet valve opens (10^o-20^o before *TDC*)

IVC : Inlet valve closes (30^o- 40^o after *BDC*)

IGN : Ignition (20^o-30^o before *TDC*)

EVO : Exit valve opens (30^o-50^o before *BDC*)

EVC : Exit valve closes (10^o-15^o after *TDC*)

04 marks

4 **c**

Explain Following terms in refrigeration:

i) One tonne of refrigeration:

A tonne of refrigeration is defined as the amount of refrigeration effect produced by the uniform melting of one tonne (1000 kg) of ice from and at 0°C in 24 hours.

Since the latent heat of ice is 335 kJ/kg

1TR = 1000 x 335 kJ in 24 hours

In actual practice, 1TR = 210 kJ/min or 3.5 kW (i.e. 3.5 kJ/s).

02

Or

A tonne of refrigeration is defined as the amount of heat required to be removed to convert 1 tonne of water at 0^0C to 1 tonne of ice at 0^0C,within the period od 24 hours.

ii) **COP:**

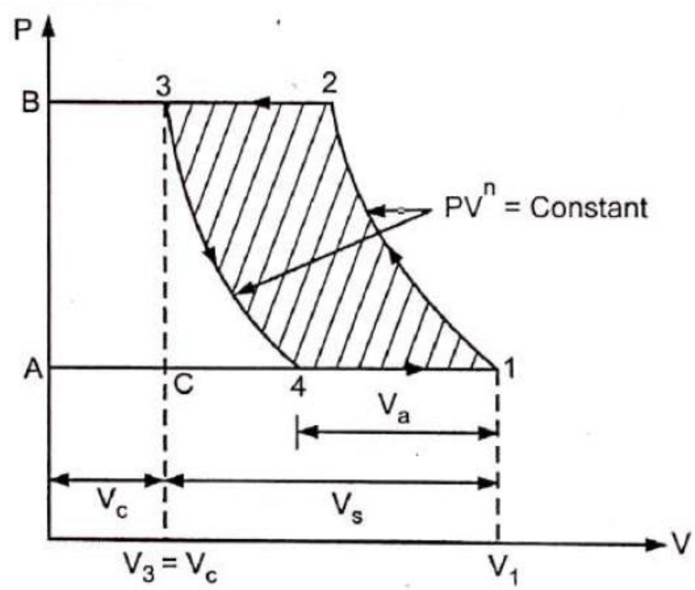
The coefficient of performance (briefly written as C.O.P.) is the ratio of heat extracted in the refrigerator to the work done on the refrigerant. It is also known as theoretical coefficient of performance.

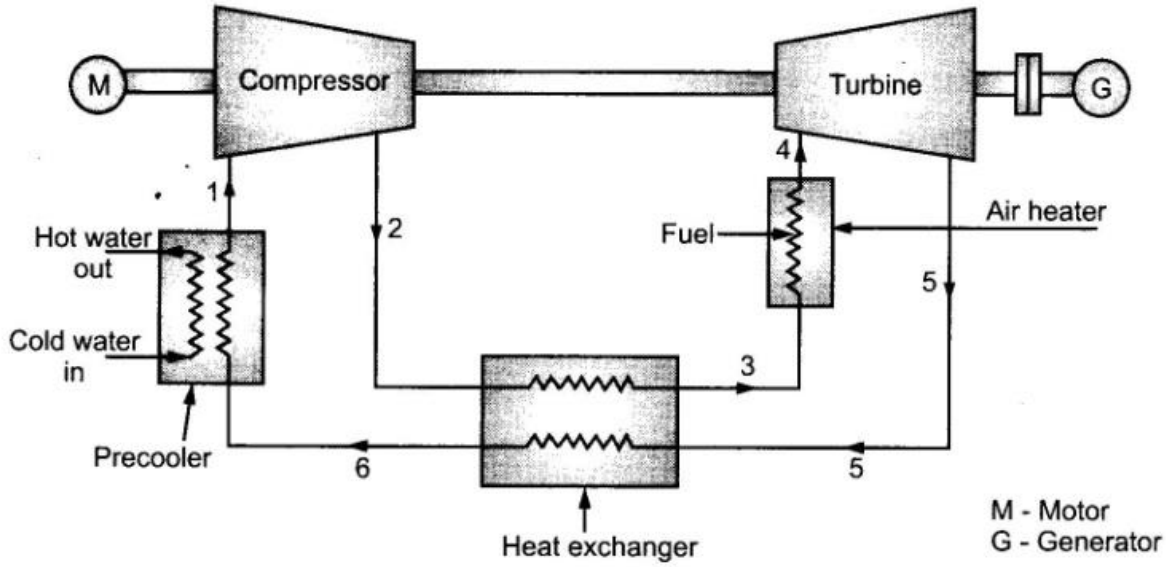
Theoretical C.O.P. = $= \frac{Q}{W}$

02

Q = Amount of heat extracted in the refrigerator (or the amount of refrigeration produced, or the capacity of a refrigerator)

W = Amount of work done.

4	D	**Explain Following Terms** **i) Isothermal efficiency:** It is defined as, "ratio of isothermal power to the indicated power". It is also called as compressor efficiency. $$\text{Isothermal efficiency} = \frac{\text{Isothermal power}}{\text{Indicated power}}$$ **ii) Volumetric Efficiency:** It is the ratio of free air delivered to the displacement of the compressor. It is also the ratio of effective swept volume to the swept volume. $$\text{Volumetric efficiency} = \frac{\text{Effective swept volume}}{\text{Swept volume}} = \frac{V_1 - V_4}{V_1 - V_3}$$  	02 02
4	E	**Explain Working of closed cycle gas turbine.**	



2 Marks

A closed cycle gas turbine, consists of a compressor, heating chamber, gas turbine, which drives the generator and compressor and a cooling chambers. In this turbine, the air is compressed isentropically generally in rotary compressor and then passed in to the heating chamber. The compressed air is heated with the help of some external source, and made to flow over the turbine, blades (Generally reaction type.) The gas while flowing over the blades gets expanded. From the turbine the gas is passed to the cooling chamber where it is cooled at constant pressure with the help of circulating water to its original temp., Now the air is made to flow into compressor again. It is thus obvious that in a closed cycle gas turbine, the air is continuously circulated within the turbine. A closed cycle gas turbine works on Joule's or Bray tons cycle.

The process 1-2 shows heating of the air in heating chamber at constant pressure. The process 2-3 shows isentropic expansion of air in the turbine similarly the process 3-4 shows cooling of the air at constant pressure in cooling chamber the process 4-1 shows isentropic compression of the air in the compressor.

2 Marks for explnation

Work done by the turbine per kg of air

$$W_T = C_P (T_2 - T_3)$$

And

Work required by the compressor per kg of air

		$W_C = C_P (T_2 - T_3)$ Now, the net work available $W = W_T - W_C$	
5		Attempt any TWO of the following:	**12**
	A	Given data:- no of cylinders = 6, d = 9·5 cm, L = 12 cm, N = 2400 rpm, orifice diameter = 3 cm = d_o $C_d = 0.6$, $h_{Hg} = 14.5$ cm, $t_a = 25°c$. ii] mass of air measured by air box method is given by, $m_a = 0.066 \cdot C_d \times d_o^2 \cdot \sqrt{h_w \rho_a}$ we know that $\therefore h_w \rho_w = h_{Hg} \times \rho_{Hg}$ $\therefore h_w = \frac{14.5 \times 13.5}{1} = 195.75$ cm $\rho_a = \frac{P}{R \cdot T} = \frac{1.013 \times 10^5}{287 \times 298} = 1.18$ Kg/m³ $\therefore m_a = 0.066 \times 0.6 \times 3^2 \sqrt{195.75 \times 1.18}$ $\boxed{m_a = 5.41 \text{ Kg/min}}$	**03**
		i] Volumetric efficiency :- Actual volume of air taken per stroke, Per cylinder at suction condition is $= \frac{V_a}{6} \times \frac{1}{N/2} \times 10^6$ cu. cm $\therefore V_a = \frac{m_a}{\rho_a} = \frac{5.41}{1.18} = 4.58$ m³/min $\therefore$ Actual volume $= \frac{4.58}{6} \times \frac{1}{1200} \times 10^6 = 636.11$ cu.cm Volumetric efficiency $= \frac{\text{Actual volume}}{\text{swept volume}}$ stroke volume $= \frac{\pi}{4} d^2 \times L = \frac{\pi}{4} \times 9.5^2 \times 12 = 850.58$ cu.cm $\boxed{\therefore \eta_v = \frac{636.11}{850.58} = 0.7478 = 74.78\%}$	**03**

5	B	Given data :- $d = 38\,cm = 0.38\,m$, $L = 20\,cm = 0.2\,m$, $V_c = 3.4\%\ V_s$, $n = 1.3$, $P_1 = 9.6\,N/cm^2 = 0.96\,bar$ $T_1 = 21^\circ C$, $P_2 = 28.84\,N/cm^2$, $N = 150\,rpm$. i] Volumetric efficiency :- $\therefore\ \eta_v = 1 - \frac{K}{100}\left[\left(\frac{P_2}{P_1}\right)^{\frac{1}{n}} - 1\right]$ $\therefore\ \eta_v = 1 - \frac{3.4}{100}\left[\left(\frac{28.84}{9.6}\right)^{\frac{1}{1.3}} - 1\right] = 0.9547$ $\boxed{\eta_v = 95.47\%}$	02
		ii] FAD m^3/min :- stroke volume/min is given by $V_s = \frac{\pi}{4} d^2 \times L \times N = \frac{\pi}{4} \times 0.38^2 \times 0.2 \times 150$ $\therefore\ V_s = 3.4\,m^3/min$ Therefore, actual air drawn in per minute, $V_a = (V_1 - V_4) = \eta_v \times V_s = 0.9547 \times 3.4$ $\therefore\ V_a = 3.24\,m^3/min$ Thus $3.24\,m^3/min$ are drawn in measured at $9.6\,N/cm^2$ & $21^\circ C$ and the free air conditions are $1.01325\,bar$ & $15^\circ C$. $\therefore\ \frac{P_{ambient} \times V_{a(ambient)}}{T_{ambient}} = \frac{P_1 V_a}{T_1}$ $\therefore\ V_{a(ambient)} = \frac{0.96 \times 3.24 \times (15 + 273)}{(21 + 273) \times 1.01325}$ $\therefore\ \boxed{FAD = 3.00\,m^3/min}$	02

iii] Indicated Power :-

$$P = \frac{n}{n-1} P_1 V_a \left[\left(\frac{P_2}{P_1} \right)^{\frac{n-1}{n}} - 1 \right]$$

$$\therefore \quad P = \frac{1.3}{1.3-1} \times \frac{0.96 \times 10^5 \times 3.24}{60 \times 1000} \times \left[\left(\frac{28.84}{9.6} \right)^{\frac{1.3-1}{1.3}} - 1 \right]$$

02

$$\boxed{P = 6.49 \text{ KW}}$$

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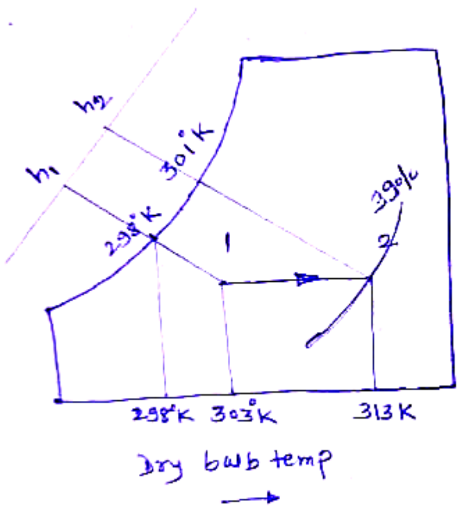
5 **C**



Given Data :-

$t_{db_1} = 303°K$

$t_{wb_1} = 298°K$

$V_1 = 300 m^3$

$t_{db_2} = 313°K$

Chart-02

i] Amount of sensible heat added :-

From Psychrometric chart,

$h_1 = 73$ KJ/Kg, $h_2 = 84$ KJ/Kg

$V_{s_1} = 0.88 \ m^3/Kg$

$\therefore$ Sensible Heat added $= m(h_2 - h_1)$

$$\therefore \quad m = \frac{V_1}{V_{s_1}} = \frac{300}{0.88} = 340.90 \text{ Kg}$$

$\therefore$ Sensible Heat added $= 340.90(84 - 73)$

02

$$\boxed{SH = 3749.9 \text{ KJ}}$$

ii] Final Relative Humidity :-

$$\boxed{RH_2 = 39\%}$$

01

iii] Final wet bulb temperature

$$\boxed{t_{wb_2} = 301°K = 28°C}$$

01

6		Attempt any TWO of the following:	12
	A	Given data :- $P_2 = 7$ bar, $V = FAD = 1 m^3/min$, $N = 300$ rpm, $P_1 = 1$ bar, $T_1 = 27°C$, $V_c = 5\% \cdot V_s$, $\eta_m = 80\%$ i] Brake power :- we know that $\eta_m = \frac{I.P.}{B.P.}$ $\therefore I.P. = \frac{n}{n-1} m_a R T_1 \left[\left(\frac{P_2}{P_1}\right)^{\frac{n-1}{n}} - 1\right] \times \frac{1}{1000}$ Where m_a is mass in kg/sec. $\therefore PV = m_a RT$ where P, V & T refer to free air $\therefore P = 1.01325$, $T = 15°C$ $\therefore 1.01325 \times 10^5 \times \frac{1}{60} = m_a \times 287 \times (273+15)$ $m_a = 0.020$ kg/sec. $\therefore I.P. = \frac{1.3}{0.3} \times 0.020 \times 287 \times 300 \left[\left(\frac{7}{1}\right)^{\frac{0.3}{1.3}} - 1\right] \times \frac{1}{1000}$ $I.P. = 4.22$ KW $\therefore B.P. = \frac{4.22}{0.8} = 5.28$ KW ii] Diameter and stroke of the cylinder :- $I.P. = \frac{P_m L A N}{1000}$ $\eta_v = 1 - \frac{K}{100}\left[\left(\frac{P_2}{P_1}\right)^{\frac{1}{n}} - 1\right]$ $= 1 - \frac{5}{100}\left[\left(\frac{7}{1}\right)^{\frac{1}{1.3}} - 1\right] = 0.826$	03

$$P_m = \frac{n}{n-1} P_1 \eta_v \left[\left(\frac{P_2}{P_1}\right)^{\frac{n-1}{n}} - 1 \right]$$

$$= \frac{1.3}{0.3} \times 1 \times 0.826 \left[(7)^{\frac{0.3}{1.3}} - 1 \right] = 2.02 \text{ bar}$$

$$\therefore \quad I.P. = \frac{P_m L A N}{1000}$$

$$4.22 = \frac{2.02 \times 10^5 \times D \times \frac{\pi}{4} \times D^2 \times \frac{300}{60}}{1000}$$

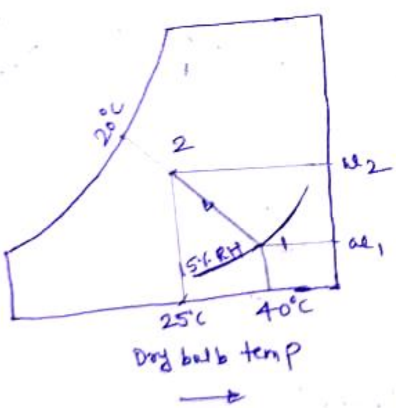
$$4.22 = 793.25 D^3$$

$$\therefore \quad D = 0.1745 \text{ m} \cong 17.45 \text{ cm}$$

$$\therefore \quad L = D = 17.45 \text{ cm}$$

03

6 B



Given data :-

$V_1 = 30{,}000 \text{ m}^3/\text{h} = 500 \text{ m}^3/\text{min}$

$t_{db_1} = 40^\circ C, \; RH_1 = 15\%$

$t_{db_2} = 25^\circ C, \; t_{wb_2} = 20^\circ C$

Chart-02

i] Dew point :-

at point ①

$t_{dp_1} = 9^\circ C$

at point ②

$t_{dp_2} = 19^\circ C$

02

ii] Rate of moisture added :-

$V_{s_1} = 0.89 \text{ m}^3/\text{kg}$

$\therefore$ mass of air $= \frac{V_1}{V_{s_1}} = \frac{500}{0.89} = 561.79 \text{ kg/min}$

moisture added $= m_a \times (\omega_2 - \omega_1) = 561.79 (0.013 - 0.007)$

$= \underline{3.37 \text{ kg/min}}$

02

6 **c**

Given data:-

Duration of trial = 1hr., $m_f = 7.6$ kg, $N = \frac{12,000}{60} = 200$ rpm

$d = 30$ cm $= 0.3$ m, $L = 45$ cm $= 0.45$ m, C.V. $= 45,000$ KJ/kg

$P_m = 6$ bar, Brake Load = ~~1.5 KN~~, 1.47 KN, $D = 1.8$ m,

rope dia $= d_o = 3$ cm, $m_w = 550$ kg, $t_{wi} = 15°c$, $t_{wo} = 60°c$

$m_{air} = 360$ kg, $t_a = 20°c$, $t_{eg} = 300°c$, $C_{peg} = 1.25$ KJ/kg K

$C_{pw} = 4.186$ KJ/kg.K.

i] Indicated & Brake power :-

$$I.P. = \frac{P_m L A n}{1000} = \frac{6 \times 10^5 \times 0.45 \times \frac{\pi}{4} \times 0.3^2 \times \frac{200}{2 \times 60}}{1000}$$

$$\boxed{I.P. = 31.80 \text{ KW}}$$

01

$$\text{effective Drum radius} = \frac{D + d_o}{2} = \frac{1.8 + 0.03}{2} = \frac{1.83}{2}$$

$$B.P. = 2\pi N T = 2 \times \pi \times \frac{200}{60} \times 1.47 \times \frac{1.83}{2}$$

$$\boxed{B.P. = 28.17 \text{ KW}}$$

01

ii] mechanical efficiency :-

$$\boxed{\eta_m = \frac{B.P.}{I.P.} = \frac{28.17}{31.80} = 88.58\%}$$

iii] Heat Balance sheet :-

(a) Heat supplied :-

$$Q_s = m_f \times C.V. = \frac{7.6}{60} \times 45,000$$

$$\boxed{Q_s = 5700 \text{ KJ/min}}$$

01

(b) Heat in B.P. = $28.17 \times 60 = 1690.2$ KJ/min 0.5

(c) Heat carried by exhaust gas:- 0.5

$$Q_{eg} = m_{eg} \times C_{peg} (t_{eg} - t_a)$$

$$\therefore Q_{eg} = \left(\frac{360+7.6}{60}\right) \times 1.25 \times (300-20)$$

$$Q_{eg} = 2144.33 \text{ KJ/min}$$

(d) Heat carried by jacket cooling water:- 0.5

$$Q_w = m_w C_{pw} (t_{wo} - t_{wi})$$

$$\therefore Q_w = 4.186 \times \frac{550}{60} \times (60-15)$$

$$Q_w = 1726.72 \text{ KJ/min}$$

(e) Heat unaccounted:- 0.5

$$Q_{un} = 5700 - (1690.2 + 2144.33 + 1726.72)$$

$$Q_{un} = 138.75 \text{ KJ/min} = 138.75 \text{ KJ/min}$$

Heat Balance sheet on minute basis. 01

Heat supplied	KJ	%	Heat distributed	KJ	%
Heat supplied by the fuel	5700	100	a) Heat in B.P.	1690.2	29.65
			b) Heat in exhaust gases	2144.33	37.61
			c) Heat carried by jacket cooling water	1726.72	30.29
			d) Heat unaccounted	138.75	2.45
				5700	100
Total	5700	100			

----------END--------
