WINTER– 16 EXAMINATION

Model Answer

Subject Code: 17413

Important Instructions to examiners:

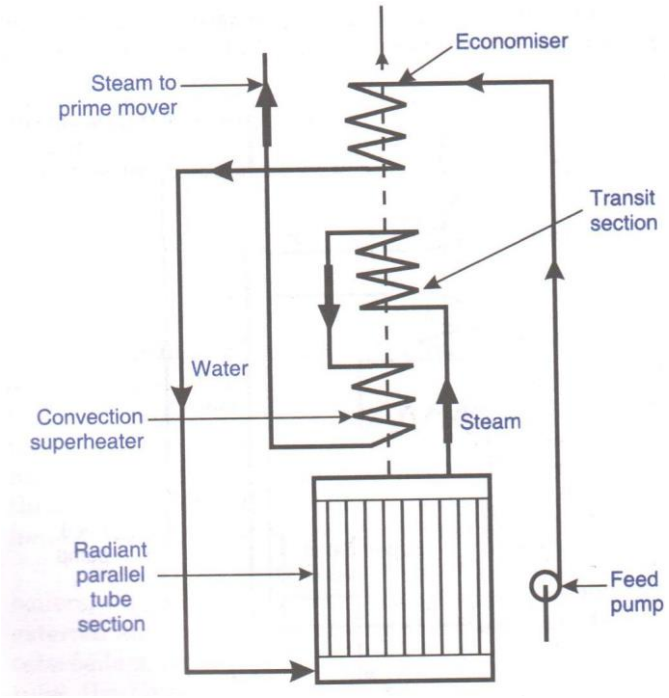
1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling 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.

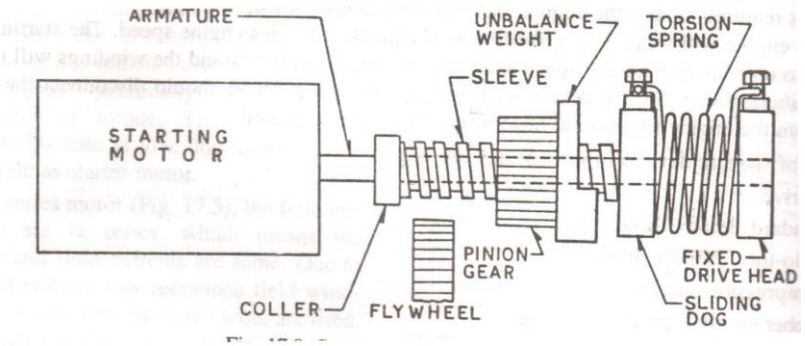
Q. No.	Sub Q. N.	Answer	Marking Scheme
1	a	**Power losses in turbines (any four)** 1. Admission losses 2. Friction losses 3. Leakage losses 4. Exhaust losses 5. Radiation and convection losses 6. Carry over losses 7. Losses due to moisture	½ for each
	b	**Provisions under Boiler Act for remedial measure (any two)** 1. Prohibitions of use of unregistered or Uncertified Boiler 2. Renewal of Certificate 3. Alteration and renewal to boilers 4. Alterations and renewals to steam – pipes	01 for each

	C	**Applications of IC engines (any four)** 1. Power generation 2. Earth moving machineries 3. Automobile 4. Helicopters & airplanes 5. Marine Engines 6. Farm machineries	½ for each
	d	**Swept Volume –** Volume displaced by the piston in one stroke is called as swept volume. **Pressure Ratio –** The ratio of pressure at the end of constant volume fuel supply process to the beginning of the process.	01 for each
	e	**Uses of compressed air any four** 1. To drive air motors in coal mines. 2. To inject fuel in air injection diesel engines. 3. To operate pneumatic drills, hammers, hoists, sand blasters. 4. For cleaning purposes. 5. To cool large buildings. 6. In the processing of food and farm maintenance. 7. In vehicle to operate air brake. 8. For spray painting in paint industry.	½ for each
	f	**Applications of Rotary Compressor (any four)** 1. Used in supercharging 2. Used in Turbo-Prop 3. Used in air-crafts 4. Used as blowers 5. Used in pneumatic applications	½ for each

	g	**Effects of leakage in suction pipe on the discharge in centrifugal pump** 1. Low discharge 2. Discharge is not uniform i.e. fluctuations in the discharge	01 for each
	h	**Manometric head -** The difference in total head across the pump known as manometric head **Static head –** The **static head**, (sometimes referred to as the pressure **head)** is a term primarily used in Hydraulics to denote the **static** pressure in a pipe, channel, or duct flow , e.g. The vertical distance between the two levels in the reservoirs is known as static head	01 for each
	i	**Classification of Reciprocating Pump** 1. Piston / Plunger type a) Single acting b)Double acting 2. No of cylinders -- a) Single cylinder b) Multi cylinder 3. Diaphragm type a) Fluid operated b) Mechanically operated	01 for each (Any two)
	j	**Advantages of super critical boiler (any four)** 1. Heat transfer surface required is hardly 20 to 25% that of the conventional boiler. 2. Increased efficiency. 3. Reduced emission 4. No need of steam dryers 5. Higher operating pressures leading to more work output. 6. Rapid start of the boiler is possible.	½ for each
	k	**Definition of Boiler & its types** Boiler is a closed vessel in which steam is produced from water by combustion of fuel. Types (Any two) 1. Horizontal, Vertical & Inclined 2. Fire tube & Water tube	01 +01

	l	3. Externally fired & Internally fired 4. Forced circulation & Natural circulation 5. High pressure & Low pressure 6. Stationary & Portable **Classification of Turbines Any four** a) According to the action of the steam 1. Impulse 2.Reaction 3. Combination b) According to the number of stages 1. Single stage 2. Multi stage c) According to the direction of steam flow 1. Axial 2. Radial d) According to the number of cylinders 1.Single cylinder 2.Multi cylinder e) According to the method of governing 1. Throttle governed 2. Nozzle governed 3. Pass governed f) According to the usage 1. Stationary 2. Non-stationary	½ for each
	m	**Need of I.C. Engine testing** With a growing demand for transportation IC engines have gained lot of importance in automobile industry. It is therefore necessary to produce efficient and economical engines. While developing an IC engine it is required to take in consideration all the parameters affecting the engine design and performance. There are enormous parameters so it becomes difficult to account them while designing an engine. So it becomes necessary to conduct tests on the engine and determine the measures to be taken to improve the engines performance.	02
	n	**Types of pumps (any two)** 1. Reciprocating Pump a) Single acting b)Double acting 2. Rotary Pump a) Vane type b) Piston type c) Screw type d) Gear type e) Lobe type	01 for each

		3. Centrifugal pump ---- a) Axial flow b) Submersible	
	o	**Reaction type turbine** 1) A turbine in which the working fluid is accelerated by expansion in both the static nozzles and the rotor blades. Torque is produced by the momentum changes in the rotor and by reaction from fluid accelerating out of the rotor. 2) In reaction turbine, steam pressure decreases gradually while expanding through the moving blades as well as the fixed blades. The steam expands while flowing over the moving blades and thus gives reaction to the moving blades.	02
2	a	Benson Boiler  	04
	b	Figure shows a standard bendix drive for the starter motor. There is a threaded sleeve on the armature shaft. The sleeve can slide or turn freely over the shaft. The shaft is keyed to the fixed drive head which is connected torsionally to the sleeve through a coil spring and a sliding dog. On the sleeve there is a pinion to which an unbalanced weight is attached. The purpose of the weight being to prevent the rotation of the pinion on the sleeve threads. When the motor starts the armature rotates causing the sleeve to rotate and because the pinion cannot rotate it moves axially towards the motor till it is engaged the flywheel and engine starts .	02+02



c 02+02

Single stage reciprocating compressor with PV diagram

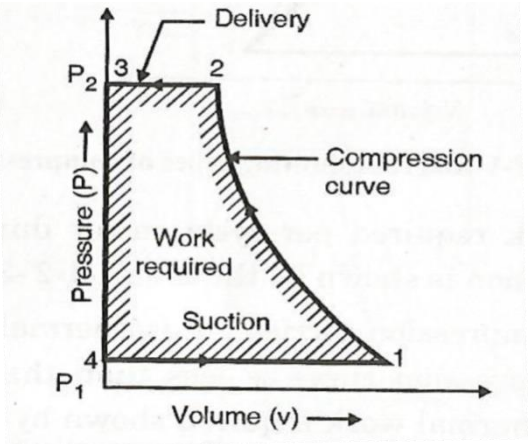


Fig: P-V diagram for single stage air compressor

The above figure shows the P-V diagram for single stage reciprocating air compressor without clearance. During the suction stroke the air is drawn into the cylinder along line 4-1 at constant pressure P_1 which is slightly below the atmosphere. At point 1, the piston completes the suction stroke and starts its compression stroke. At this time, all the valves are closed; the air inside the cylinder is compressed along the curve 1-2. At point 2, the pressure P_2 is reached which is slightly higher than the receiver pressure. At this point discharge valve opens delivery of compressed air takes place along line 2-3 at constant pressure P_2. The piston has now reached at top of cylinder and again starts its suction stroke & the pressure in the cylinder will be lowered again P_1 & the cycle of operations will be repeated. The net work done required is represented by area 1-2-3-4. 02+02

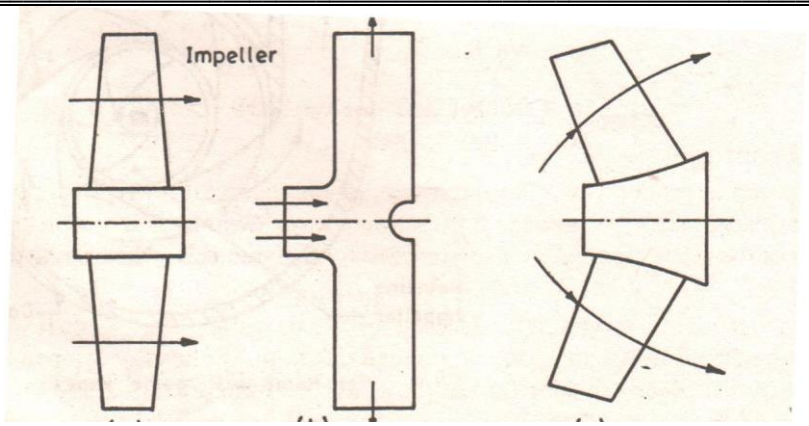
d

Types of impellers in centrifugal pumps

a) Open impellers - used in small-diameter, inexpensive pumps and pumps handling suspended solids.

b) Partially open or semi closed impellers - used in medium-diameter pumps and with liquids containing small amounts of suspended solids

c) Closed impellers - is the most widely used type of impeller for centrifugal pumps handling clear liquids



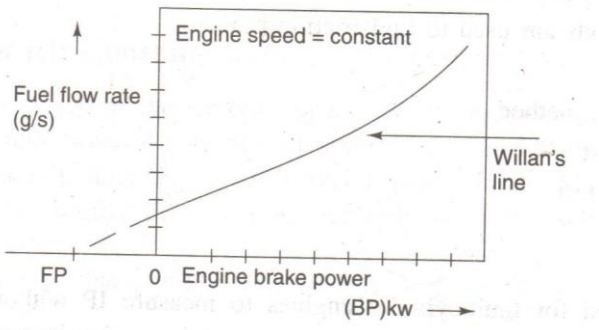
01 for each

e Difference between impulse and reaction turbine Any four

Impulse turbine		Reaction turbine	
1.	Steam completely expand in nozzle & pressure remain constant during flow through the blade passage	1.	Steam expand partially in nozzle and further expansion take in rotor blade passage.
2.	Relative velocity of steam passing over blades of impulse turbine is constant.	2.	Relative velocity increases as steam passing over the blade expands.
3.	Blade is symmetrical profile	3.	Blade is aerofoil section.
4.	Pressure is same at inlet and outlet	4.	Pressure is different at inlet and outlet.
5.	Steam velocity is very high	5.	Steam velocity is not very high
6.	Lesser no of stages require	6.	More no. of stages requires
7.	Occupies less space per unit power	7.	Occupies more space per unit power
8.	Suitable for small power.	8.	Suitable for higher power.
9.	At low load the efficiency is low	9.	At low load, the efficiency is high

02+02

f Willans straight line method for measurement of friction power:



In Willans straight line method graph is plotted as brake power on x axis verses power consumption on y axis at constant speed. The intercept of negative side of brake power is taken as a friction power of the engine at constant speed, this is assuming linear relation between fuel consumption and BP .

g IC engines classifications: Any four

01 for each

Types of Internal Combustion Engines:

1. Based on the fuel used
    1. Diesel Engine
    2. Petrol Engine (or Gasoline Engine)
2. Based on the type of cycle
    1. Otto Cycle Engine
    2. Diesel Cycle Engine
    3. Dual Cycle Engine
3. Based on the number of strokes per cycle
    1. Two-stroke Engine
    2. Four-stroke Engine
4. Based on the number of cylinders
    1. Single Cylinder Engine
    2. Multi cylinder Engine
        i. Twin Cylinder Engine
        ii. Three Cylinder Engine
        iii. Four Cylinder Engine
        iv. Six Cylinder Engine
        v. Eight Cylinder Engine
        vi. Twelve Cylinder Engine
        vii. Sixteen Cylinder Engine

	a	5. Based on the type of ignition 1. Spark Ignition Engine (S.I. Engine) 2. Compression Ignition Engine (C.I. Engine) 6. Based on the lubrication system used 1. Dry sump lubricated engine 2. Wet sump lubricated Engine 7. Based on the cooling system used 1. Air-cooled Engine 2. Water-cooled Engine 8. Based on the arrangement of valves 1. L-head Engine 2. I-head Engine 3. T-head Engine 4. F-head Engine 9. Based on the position of cylinders 1. Horizontal Engine 2. Vertical Engine 3. Radial Engine 4. Opposed Piston Engine 5. Opposed Cylinder Engine 6. V Engine 7. W Engine 8. Inline Engine 10. Based on the pressure boost given to the inlet air or air-fuel mixture 1. Naturally aspired Engine 2. Supercharged Engine 3. Turbocharged Engine 4. Crankcase compressed Engine 11. Based on application 1. Automobile Engine 2. Aircraft Engine 3. Locomotive Engine 4. Marine Engine 5. Stationary Engine	01 for each

3 **b**

Differentiate between Boiler and Supercritical boiler Any four

Boiler		Supercritical Boiler	
1	It is used in small plants	1	It is used in large plants
2	Heat transfer rate is small	2	Heat transfer rate is high
3	Pressure level is variable therefore response is not better	3	Pressure level is variable therefore response is better
4	Problem of erosion and corrosion is there.	4	Problem of erosion and corrosion is not there.
5	Adaptable for stable load	5	Adaptable for fluctuating load
6	Low thermal efficiency	6	High thermal efficiency
7	Installation of boiler is simple	7	Installation of boiler is complicated
8	Capable of quick starting	8	Not Capable of quick starting

01 for each

c

Sr. No.	Fault	Remedies
01	Piston Seizure	1. Use good quality of fuel and mix oil. 2. Avoid over – revving the engine. 3. Keep cooling fins clean. 4. Check cooling system, water pump etc.
02	Engine overheating	1. Avoid engine cooling system leakages. 2. Avoid wrong coolant concentration. 3. Check Thermostat. 4. Check blocked coolant passages.
03	Engine turn slowly	1. Check Battery condition/terminal wires. 2. Check spark plug for SI engine. 3. Check carburetor for SI and Fuel pump for CI. 4. Check ignition switch wires.
04	No spark- at spark plug	1. Check wire by cranking .(remove cap of plug and bring wire in contact with metal by keeping small gap) 2. Check spark plug without fitting and by cranking. 3. Adjust the gap of the spark plug. 4. Check ignition coil.

01 for each

d

Methods of Energy saving in air compressor : any four

1. Cooling cylinder by spraying water during compression stroke.
2. Circulation of water surrounding to cylinder by providing jackets
3. Installing inter cooler between two cylinders
4. Providing greater fins on cylinder
5. By selecting suitable material for cylinder
6. By providing suitable choice of cylinder proportions i.e. short stroke and large bore in construction with sleeve valve

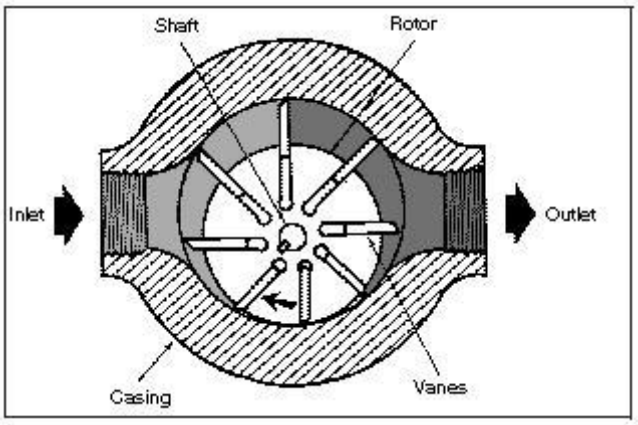
e

Vane Pump :

A Vane Pump is a particular type of positive displacement pump. Its principle of operation is to use the back and forth movement of rectangle shaped vanes inside slots to move fluids. They are sometimes also referred to as sliding vane pumps.

The simplest vane pump consists of a circular rotor rotating inside of a larger circular cavity. The center's of the two circles are offset, causing eccentricity. Vanes are allowed to slide into and out of the rotor and seal on all edges, creating vane chambers that do the pumping work. On the intake side of the pump, the vane chambers are increasing in volume. These increasing volume vane chambers are filled with fluid forced in by the inlet pressure. Inlet pressure is actually the pressure from the system being pumped, often just the atmosphere. On the discharge side of the pump, the vane chambers are decreasing in volume, forcing fluid out of the pump. The action of the vane drives out the same volume of fluid with each rotation

02+02



01 for each

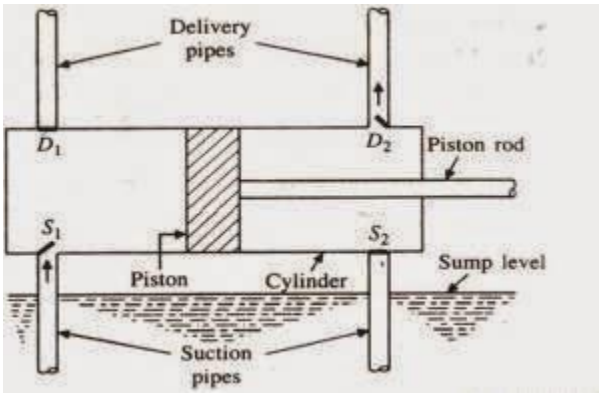
Differentiation between reciprocating and centrifugal compressor any four

f

Reciprocating compressor	Centrifugal compressor
1. Reciprocating compressors have poor mechanical efficiency due to large sliding parts.	1. Centrifugal compressors have better mechanical efficiency due to absence of sliding parts
2. Delivery of air intermittent.	2. Delivery of air is continuous.
3. Delivery pressure is high i.e. pressure ratio is high.	3. Delivery pressure is low, i.e. pressure ratio is low.
4. Flow rate of air is low.	4. Flow rate of air is high.
5. Reciprocating compressors produce greater noise and vibrations.	5. Centrifugal compressors have comparatively salient operation.
6. Speed of compressor is low because of unbalanced forces.	6. Speed of compressor is high because of perfect balancing.
7. Reciprocating air compressor has more number of moving parts.	7. Centrifugal compressor has less number of moving part.
8. It needs proper lubrication and more maintenance.	8. It required less lubrication and maintenance.
9. Due to low speed , it can't be directly coupled to prime mover but it requires reduction of speed.	9. Can be directly coupled to prime mover.
10. It is used when small quantity of air at high pressure is required.	10. It is used where large quantity of air at lower pressure is required.

02+02

Double acting reciprocating pump



Double acting reciprocating pump:- In a Double-acting reciprocating pump, each stroke of the piston carries out both the functions, suction as well as delivery. Thus it require two suctions pipes and two delivery pipes for double-acting pump. When there is a suction stroke on one side of the piston, there is at the same time a delivery stroke on the other side of the piston. Thus for one complete revolution of the crank there are two delivery strokes and water is delivered to the pipes by the pump during these two delivery strokes.
Discharge through a double-acting reciprocating pump.
D1= delivery valve(closed)
D2= delivery valve(being opened)
S1= suction valve (being opened)
S2= Suction valve (closed)

$$Q = \frac{2ALN}{60} \text{ m}^3/\text{sec}$$

Discharge : The above equation gives the discharge of double acting reciprocating pump. This discharge is two times the discharge of a single acting pump

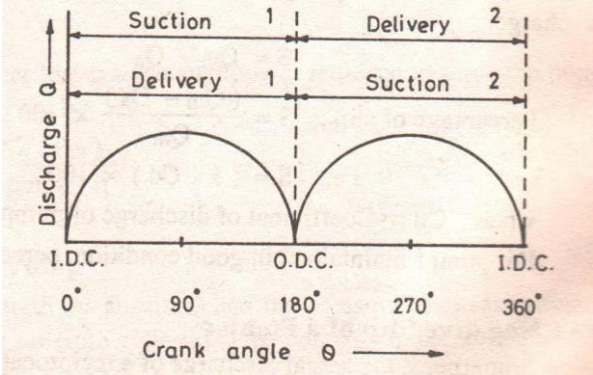


Figure shows the Ø-Q diagram for double acting reciprocating pump.