

Seat No.: \_\_\_\_\_

Enrolment No. \_\_\_\_\_

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**BE –SEMESTER 1&2(NEW SYLLABUS)EXAMINATION- WINTER 2018**

**Subject Code: 3110006**

**Date: 05-01-2019**

**Subject Name: Basic Mechanical Engineering**

**Time: 10:30 am to 01:00 pm**

**Total Marks: 70**

**Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

		<b>Marks</b>
Q.1	(a) Discuss Closed, Open and Isolated Thermodynamic system with neat sketch.	<b>03</b>
	(b) What is solid fuel? Discuss different types of solid fuel.	<b>04</b>
	(c) Describe Isothermal process and derive expression for Workdone, Change in Internal energy, Heat transfer and Change in Enthalpy.	<b>07</b>
Q.2	(a) Dryness fraction of steam cannot have the value more than unity: Justify	<b>03</b>
	(b) Explain Steam formation T-h plot	<b>04</b>
	(c) The heat transfer from a heat reservoir is proportional to its temperature: Justify by deriving equation.	<b>07</b>
	<b>OR</b>	
	(c) 1.5kg of steam at a pressure of 10bar and temperature of 250°C is expanded until the pressure becomes 2.8bar. The dryness fraction of steam is then 0.9. Calculate change in Internal Energy	<b>07</b>
Q.3	(a) List different mountings of boiler and explain any one in brief.	<b>03</b>
	(b) Explain: Smoke tube internally fired horizontal type stationary boiler.	<b>04</b>
	(c) The efficiency of Otto cycle is a function of compression ratio: Prove it.	<b>07</b>
	<b>OR</b>	
Q.3	(a) What is throttling calorimeter? Explain its limitation.	<b>03</b>
	(b) Discuss Rankine cycle with block diagram	<b>04</b>
	(c) What is split AC? How it works? Explain with advantage and disadvantage.	<b>07</b>
Q.4	(a) Explain the term: (i) Swept volume (ii) Clearance volume (iii) Stroke length	<b>03</b>
	(b) Discuss with neat sketch Diaphragm pump.	<b>04</b>
	(c) Distinguish between Reciprocating and Rotary Compressor.	<b>07</b>
	<b>OR</b>	
Q.4	(a) Explain with neat sketch single acting Plunger type pump.	<b>03</b>
	(b) Explain need of multi staging in reciprocating air compressor with its advantages.	<b>04</b>

- (c) The following readings were taken during the test on a single cylinder four stroke IC engine: **07**
- |                                  |              |
|----------------------------------|--------------|
| Cylinder diameter                | : 270mm      |
| Stroke Length                    | : 380mm      |
| Mean Effective Pressure          | : 6bar       |
| Engine speed                     | : 250rpm     |
| Net load on brake                | : 1000N      |
| Effective mean diameter of brake | : 1.5m       |
| Fuel used                        | : 10kg/hr    |
| Calorific value of Fuel          | : 44400kJ/kg |
- Calculate:
- (i) Brake Power
  - (ii) Indicated Power
  - (iii) Mechanical Efficiency
  - (iv) Indicated thermal efficiency

- Q.5 (a) Discuss the term: **03**
- (i) Condenser
  - (ii) Baffle tray
  - (iii) Evaporator
- (b) Explain with neat sketch the working of Internal Expanding Shoe Brake. **04**
- (c) Discuss the following with application and Properties: **07**
- (i) Glass
  - (ii) Ceramic
  - (iii) Plastics

**OR**

- Q.5 (a) How metals are classified? Show with block diagram **03**
- (b) Give brief comparison between Belt, Chain and Gear drive. **04**
- (c) Explain with sketch: **07**
- (i) Centrifugal clutch
  - (ii) Fast and Loose pulley drive

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**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER– I & II (NEW) EXAMINATION – WINTER 2019****Subject Code: 3110006****Date: 03/01/2020****Subject Name: Basic Mechanical Engineering****Time: 10:30 AM TO 01:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Use of steam tables is allowable

		Marks
<b>Q.1</b>	(a) Define prime movers. Write any Four examples of the prime movers.	<b>03</b>
	(b) Define the terms: Hardness, Toughness, Ductility, Elasticity	<b>04</b>
	(c) List the non-convectional sources of energy. Prepare a short note on solar energy.	<b>07</b>
<b>Q.2</b>	(a) Distinguish between coupling and clutch.	<b>03</b>
	(b) Describe briefly using neat diagrams the types of belt drives.	<b>04</b>
	(c) Explain with neat sketch the Vapor Compression Refrigeration system. Also draw p-h and T-s diagram for the same.	<b>07</b>
	<b>OR</b>	
	(c) Classify Air Compressors. Explain construction and working of centrifugal pump with sketch.	<b>07</b>
<b>Q.3</b>	(a) Prove that the difference between two specific heats of gases is equal to its characteristic gas constant.	<b>03</b>
	(b) Differentiate between gas constant and Universal gas constant.	<b>04</b>
	(c) One kg of gas at a pressure of 100 kPa and temperature of 17 °C is compressed isothermally in a piston-cylinder arrangement to final pressure of 2500 kPa. The characteristic gas equation is given by the relation $pV = 260 T$ per kg where T is in Kelvin. Find out (1) Final Volume (2) Compression Ratio (3) Change in enthalpy (4) Work done on the gas.	<b>07</b>
	<b>OR</b>	
<b>Q.3</b>	(a) One kg gas is compressed adiabatically by following the law $pV^\gamma = C$ from initial temperature of 290K. The initial pressure of gas is 1 bar. The initial and final volumes of gas are 0.50 m <sup>3</sup> and 0.05 m <sup>3</sup> respectively. Find the final temperature and pressure of gas. Assume $\gamma=1.4$	<b>03</b>
	(b) Write the uses of “Steam Tables”	<b>04</b>
	(c) Find the internal energy of 1 kg of steam at a pressure of 15 bar when steam is (1) Super-heated at a temperature of 400 °C and (2) Wet with dryness fraction of 0.9. Take specific heat of superheated steam as 2.1 kJ/kg-K.	<b>07</b>
<b>Q.4</b>	(a) A diesel engine works on Diesel cycle with a compression ratio of 15 and cut off ratio of 1.75. Calculate the air standard efficiency. Assume $\gamma= 1.4$ .	<b>03</b>
	(b) Derive the equation for air standard efficiency of Otto cycle.	<b>04</b>
	(c) The following readings were observed during a test on Two Stroke Single Cylinder Diesel engine:	<b>07</b>
	Bore	= 22 cm
	Stroke	= 28 cm
	Speed	= 350 rpm

Net brake load	=	65 kg
Effective brake drum diameter	=	100 cm
Mean Effective Pressure	=	3 bar
Fuel consumption	=	4 kg/h
Calorific value of fuel	=	43 MJ

Calculate: (1) Indicated Power (2) Brake Power (3) Mechanical Efficiency (4) Brake thermal Efficiency

**OR**

- Q.4**
- (a) Classify I.C. Engines. **03**
  - (b) Determine the brake thermal efficiency of an engine with following data: **04**  
 Brake Power = 80 kW  
 Fuel consumption rate = 20 kg/hour  
 Calorific value of the fuel = 43 MJ/kg
  - (c) Discuss the construction and working of four stroke Petrol engines. **07**

- Q.5**
- (a) Define the terms 'Refrigeration', "Ton of Refrigeration" and "Coefficient of Performance" **03**
  - (b) What is boiler? Compare fire tube boiler with water tube boiler. **04**
  - (c) Explain with neat sketch, the construction and working of **07**  
 (1) Fusible plug (2) Air preheater.

**OR**

- Q.5**
- (a) Differentiate between reciprocating compressor and rotary compressor. **03**
  - (b) Differentiate between boiler mountings and accessories. **04**
  - (c) Discuss the construction details and working of Cochran boiler with neat sketch. **07**

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**GUJARAT TECHNOLOGICAL UNIVERSITY****BE- SEMESTER-I & II (NEW) EXAMINATION – WINTER 2020****Subject Code:3110006****Date:18/03/2021****Subject Name:Basic Mechanical Engineering****Time:10:30 AM TO 12:30 PM****Total Marks:56****Instructions:**

1. Attempt any FOUR questions out of EIGHT questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Use of steam tables is permitted in exam

		Marks
<b>Q.1</b>	(a) List advantages of Solar energy and its application.	<b>03</b>
	(b) Explain phenomena of global warming and causes of ozone depletion.	<b>04</b>
	(c) Define the following terms: Prime movers, Internal energy, heat capacity, first law of thermodynamics, state, Path, Zeroth law of thermodynamics.	<b>07</b>
<b>Q.2</b>	(a) Classify pumps on basis of principle, construction, and fluid flow direction in pump.	<b>03</b>
	(b) Explain the following terms: volumetric efficiency, compression ratio.	<b>04</b>
	(c) With usual notations derive expression to determine efficiency of Otto Cycle.	<b>07</b>
<b>Q.3</b>	(a) Define the following terms: Boyles law, Avogadro's law, Charles Law.	<b>03</b>
	(b) A Vessel of 2.5 m <sup>3</sup> capacity contains one kg –mole of nitrogen at 100°C. Calculate the specific volume and pressure if the gas is cooled to 30°C, calculate final pressure, change in specific internal energy and specific enthalpy.	<b>04</b>
	(c) Explain adiabatic process. Derive an expression for work done during the adiabatic expansion of an ideal gas.	<b>07</b>
<b>Q.4</b>	(a) What is superheated steam, list its advantages and application.	<b>03</b>
	(b) With neat sketch explain construction and working of separating calorimeter.	<b>04</b>
	(c) Calculate the internal energy of 1 kg of superheated steam at a pressure of 10 bar and 280°C. If this steam is to be expanded to a pressure of 1.6 bar and 0.8 kg dry, determine the change in internal energy. Assume specific heat of superheated steam as 2.1 k J /kg K.	<b>07</b>
<b>Q.5</b>	(a) In an Otto cycle the temperature at the beginning and end of the isentropic compression are 316 K and 596 K resply. Determine the air standard efficiency and compression ratio. Assume $\gamma=1.4$	<b>03</b>
	(b) With neat sketch explain construction and working of water level indicator.	<b>04</b>
	(c) Draw neat sketch of an internal combustion engine, list its parts and state functions of each.	<b>07</b>
<b>Q.6</b>	(a) Compare reciprocating compressor and rotary compressor.	<b>03</b>
	(b) List essential qualities of a good boiler.	<b>04</b>

- (c) During a trial on single cylinder oil engine, working on the four stroke cycle and fitted with rope brake the following readings were taken, Effective diameter of brake wheel= 630mm, dead load on the brake=200N, spring balance reading=30N, Speed =450rpm, Area of indicator diagram=420mm<sup>2</sup>, length of indicator diagram=60mm, spring scale=1.1 bar per mm, diameter of cylinder=100mm, stroke=150mm, quantity of oil used =0.815kg/hr, calorific fuel of oil =42,000k J /kg, Calculate brake power, indicated power, mechanical efficiency, brake thermal efficiency, and brake specific fuel consumption. **07**
- Q.7** (a) Draw neat sketch of domestic refrigerator and list its different parts. **03**  
 (b) Compare belt drive, chain drive and gear drive. **04**  
 (c) List and explain physical, thermal, mechanical and electrical properties of metals. **07**
- Q.8** (a) Explain working of split air conditioner. **03**  
 (b) List properties of copper and its applications. **04**  
 (c) Draw sketch and label the following: shoe brake, cone clutch, flange coupling **07**

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**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-1/2 EXAMINATION – WINTER 2021****Subject Code:3110006****Date:30/03/2022****Subject Name:Basic Mechanical Engineering****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

- Q-1**
- (a) Define zeroth law of thermodynamics, and First law of thermodynamics. **03**
- (b) With usual notations prove that  $C_p - C_v = R$ . **04**
- (c) Write a difference between SI engine and CI engine. **07**

- Q-2**
- (a) Describe the process of formation steam on T-H diagram. **03**
- (b) Write a short note on “Global Warming and solar energy” **04**
- (c) Ford car having a four cylinder, four stroke petrol engine has 100 mm bore and stroke is 1.25 times the bore. It consumes 4 kg of fuel per hour having calorific value of 41,000 kJ/kg. The engine speed is 800 rpm. Calculate indicated thermal efficiency if mean effective pressure is 0.75 MPa. **07**

**OR**

- (c) A 4-cylinder, two-stroke cycle petrol engine develops 30 kW at 2500 rpm. The mean effective pressure on each piston is 8 bar and mechanical efficiency is 80%. Calculate the diameter and stroke of each cylinder if stroke to bore ratio is 1.5. Also the fuel consumption of engine, if brake thermal efficiency is 28% and calorific value is 43900 kJ/kg. **07**

- Q-3**
- (a) How do you classify steam boilers? **03**
- (b) Draw labeled diagram of Babcock and wilcox boiler. **04**
- (c) An air standard Otto cycle has compression ratio of 6. The temperature at the start of compression is 25°C and pressure is 1 bar. If the maximum temperature of the cycle is 1150°C. Calculate (a) the heat supplied and heat rejected per kg of air (b) network done per kg of air and (c) thermal efficiency of cycle. Assume  $\gamma=1.4$ ,  $C_v=0.778$  kJ/kg K for air. **07**

**OR**

- Q-3**
- (a) List out application of compressed air. **03**
- (b) Explain single acting reciprocating pump. **04**
- (c) One kg of a gas at 1 bar pressure and 17°C is compressed isothermally to a pressure of 25 bar in a cylinder. The characteristic gas constant is 260 J/kg K. calculate (a) the final temperature (b) work done and (c) change in enthalpy. **07**

- Q-4**
- (a) What is priming? Why priming is required in centrifugal pump but not in reciprocating pump. **03**
- (b) Define (i) Dryness fraction (ii) wetness fraction. **04**
- (c) Explain vapour compression refrigeration cycle used in domestic refrigerator. **07**

**OR**

- Q-4**
- (a) Write function of clutch, Break and Coupling. **03**
- (b) Compare belt drive, chain drive and gear drive. **04**

- (c) Define following mechanical properties: (1) Elasticity (2) Malleability (3) Ductility (4) Stiffness (5) Hardness (6) Toughness (7) Resilience. **07**
- Q-5** (a) Explain open system, closed system and isolated system. **03**  
(b) Define (i) one ton of refrigeration (ii) COP. **04**  
(c) Explain construction and working of centrifugal compressor with neat sketch. **07**
- OR**
- Q-5** (a) Define ferrous and Nonferrous material with example. **03**  
(b) Explain types of Belt Drives. **04**  
(c) Write a short on a single plate (disc) friction clutch. **07**

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**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-I & II (NEW) EXAMINATION – SUMMER-2019****Subject Code: 3110006****Date: 04/06/2019****Subject Name: Basic Mechanical Engineering****Time: 10:30 AM TO 01:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Use of steam table is permitted.

		<b>Marks</b>
<b>Q.1</b>	(a) Define Melting point, Boiling point and Trippl point of water using p-v diagram.	<b>03</b>
	(b) Derive an expression for internal energy for a closed system.	<b>04</b>
	(c) Define specific heat at Constant volume, constant pressure and Adiabatic index. Also derive relationship between specific heats in form of Characteristic gas constant.	<b>07</b>
<b>Q.2</b>	(a) Discuss the factors responsible for global warming and Ozone depletion	<b>03</b>
	(b) Explain Equivalent evaporation and factor of evaporation	<b>04</b>
	(c) Determine the value of final dryness fraction of steam <ol style="list-style-type: none"> <li>1. After losing 125 kJ from the steam at constant pressure.</li> <li>2. After expansion to 3 bar pressure in a turbine stage and work equivalent of 20 kJ/kg done</li> </ol> Initially steam is available at 7 bar pressure and 0.9 dryness fraction.	<b>07</b>
	<b>OR</b>	
	(c) Three kg of steam at a pressure of 10 bar exists in the following conditions. Calculate its enthalpy and internal energy in each of the cases. <ol style="list-style-type: none"> <li>1. Steam with <math>x = 0.91</math></li> <li>2. Steam at temperature <math>200^{\circ}\text{C}</math></li> </ol>	<b>07</b>
<b>Q.3</b>	(a) Explain the construction and function of Steam Trap with neat sketch. Also mention its specific location in the system.	<b>03</b>
	(b) Derive the equation for efficiency of Carnot	<b>04</b>
	(c) A double acting reciprocating pump has piston diameter of 150 mm and stroke length of 225 mm. the suction and delivery heads are 4 m and 12 m respectively. If the speed of the pump is 80 rpm and the actual quantity of water discharged is $0.61\text{ m}^3/\text{min}$ . find the percentage slip, the coefficient of discharge and the power required to drive the pump if the efficiency of the pump is 80%.	<b>07</b>
	<b>OR</b>	
<b>Q.3</b>	(a) Explain the construction and function of Steam separator with neat sketch. Also mention its specific location in the system.	<b>03</b>
	(b) Prove that the efficiency of Otto cycle is greater than that of Diesel cycle for the same compression ratio.	<b>04</b>
	(c) Air is to be compressed in a single stage reciprocating compressor from 1.013 bar and $15^{\circ}\text{C}$ to 7 bar. Calculate the indicated power required for free air delivery of $0.3\text{ m}^3/\text{min}$ when the compression process is <ol style="list-style-type: none"> <li>1. Isentropic</li> <li>2. Reversible isothermal</li> <li>3. Polytropic with <math>n = 1.25</math>.</li> </ol>	<b>07</b>

- Q.4** (a) Draw a neat sketch of p-v diagram for single stage compressor with clearance. **03**
- (b) It is required to produce ice from 36° water. The capacity of the ice plant is 6 ton and specific heat of the water is 4.18 KJ/kg.K. Determine the amount of ice produced in 3 hours. **04**
- (c) In an ideal Otto cycle the air at the beginning of isentropic compression is at 1 bar and 15°C. The ratio of compression is 8. If the heat added during the constant volume process is 1000 kJ/kg, determine (a) the maximum temperature in the cycle, (b) the air standard efficiency (C) work done per kg of air. **07**

**OR**

- Q.4** (a) Draw a neat sketch of p-v diagram showing Free Air Delivery for air compressor. **03**
- (b) Calculate the energy consumed in one month for following conditions: **04**  
 COP of air-conditioning unit : 5  
 Capacity of air conditioner : 2 TR  
 No of air conditioners : 8  
 All air conditioners run for 4 hours/day.
- (c) A petrol engine with a stroke length of 200 mm and diameter of 150 mm has a clearance volume of  $7 \times 10^5 \text{ mm}^3$ . If the indicated thermal efficiency is 0.30, find the relation efficiency. If the effective pressure is 5 bar and engine runs at 1000 rpm. Find the IP of the engine. take  $\gamma=1.4$  **07**

- Q.5** (a) Discuss the operational difference between Vapour compression and Vapour absorption refrigeration cycle **03**
- (b) Define velocity ratio of pulleys and discuss effect of slip and creep on motion transmission, **04**
- (c) Using neat sketch explain the working of Cone clutch and Centrifugal clutch **07**

**OR**

- Q.5** (a) Define following material properties. **03**  
 1. Ductility  
 2. Plasticity  
 3. Malleability
- (b) Define pitch circle, diametral pitch, addendum and dedendum using neat sketch. **04**
- (c) Using neat sketch explain the working of Block brake and Internal expanding shoe brake. **07**

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**GUJARAT TECHNOLOGICAL UNIVERSITY****BE – SEMESTER 1&2 EXAMINATION – SUMMER 2020****Subject Code: 3110006****Date: 06/11/2020****Subject Name: Basic Mechanical Engineering****Time: 10:30 AM TO 01:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

		MARKS
<b>Q.1</b>	(a) Discuss Closed, Open and Isolated Thermodynamic system with neat sketch.	<b>03</b>
	(b) Define the terms: Hardness, Toughness, Ductility, Elasticity	<b>04</b>
	(c) Derive an expression for internal energy for a closed system	<b>07</b>
<b>Q.2</b>	(a) Distinguish between coupling and clutch.	<b>03</b>
	(b) Explain Equivalent evaporation and factor of evaporation	<b>04</b>
	(c) The heat transfer from a heat reservoir is proportional to its temperature: Justify by deriving equation.	<b>07</b>
	<b>OR</b>	
	(c) Explain construction and working of centrifugal pump with a neat sketch	<b>07</b>
<b>Q.3</b>	(a) Explain the construction and function of Steam Trap with neat sketch	<b>03</b>
	(b) Write the uses of “Steam Tables”	<b>04</b>
	(c) 1.5kg of steam at a pressure of 10bar and temperature of 250°C is expanded until the pressure becomes 2.8 bars. The dryness fraction of steam is then 0.9. Calculate change in Internal Energy	<b>07</b>
	<b>OR</b>	
<b>Q.3</b>	(a) List different mountings of boiler and explain any one in brief.	<b>03</b>
	(b) Derive the equation for air standard efficiency of Otto cycle.	<b>04</b>
	(c) A petrol engine with a stroke length of 200 mm and diameter of 150 mm has a clearance volume of $7 \times 10^5 \text{ mm}^3$ . If the indicated thermal efficiency is 0.30, find the relation efficiency. If the effective pressure is 5 bar and engine runs at 1000 rpm. Find the IP of the engine. take $\gamma=1.4$	<b>07</b>
<b>Q.4</b>	(a) Discuss with neat sketch Diaphragm pump.	<b>03</b>
	(b) Distinguish between Reciprocating and Rotary Compressor.	<b>04</b>
	(c) Discuss the construction and working of four stroke Petrol engine.	<b>07</b>
	<b>OR</b>	
<b>Q.4</b>	(a) Draw a neat sketch of p-v diagram showing Free Air Delivery for air compressor.	<b>03</b>
	(b) Define the terms ‘Refrigeration’, “Ton of Refrigeration” and “Coefficient of Performance”	<b>04</b>

- (c) Calculate the energy consumed in one month for following conditions: COP of air-conditioning unit : 5  
Capacity of air conditioner :  
2 TR No of air conditioners : 8  
All air conditioners run for 4 hours/day. **07**
- Q.5** (a) What is throttling calorimeter? Explain its limitation **03**  
(b) Discuss with neat sketch any two boiler accessories. **04**  
(c) Give comparison between Belt, Chain and Gear drive. **07**
- OR**
- Q.5** (a) How metals are classified? Show with block diagram **03**  
(b) Define velocity ratio of pulleys and discuss effect of slip and creep on motion transmission **04**  
(c) Discuss the following with application and Properties: **07**  
    (i) Glass  
    (ii) Ceramic  
    (iii) Plastics

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**GUJARAT TECHNOLOGICAL UNIVERSITY****BE- SEMESTER-I & II(NEW)EXAMINATION – SUMMER 2022****Subject Code:3110006****Date:03-08-2022****Subject Name:Basic Mechanical Engineering****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

**MARKS**

- Q.1**
- |   |           |
|---|-----------|
| (a) Define (1) Critical Point (2) Enthalpy (3) Extensive property.                  | <b>03</b> |
| (b) Give advantages of liquid fuels compared to solid fuels.                        | <b>04</b> |
| (c) Derive the characteristics gas equation for a perfect gas with usual notations. | <b>07</b> |

- Q.2**
- |   |           |
|---|-----------|
| (a) Give comparison between work and heat.  | <b>03</b> |
| (b) Define (1) sensible heat (2) Latent heat (3) Degree of superheat (4) Specific volume of steam.  | <b>04</b> |
| (c) A 4 cylinder, 4 stroke marine oil engine has a cylinder diameter of 490 mm and a piston stroke of 1000 mm. the engine uses 130 kg of fuel of calorific value 42000 KJ/kg in one hour when running at 2 rev/sec. the torque transmitted at the engine coupling is 22 KN.m and indicated mean effective pressure 710 KN/m <sup>2</sup> . Determine (1) Indicated power (2) Brake power (3) Brake thermal efficiency (4) Mechanical efficiency (5) Indicated thermal efficiency. | <b>07</b> |

**OR**

- |  |           |
|--|-----------|
| (c) A two-cylinder four stroke petrol engine has swept volume of $1.1 \times 10^{-3} \text{ m}^3$ . It run at 950 rpm and consume 2.2 kg of petrol per hour having calorific value of 43000 KJ/kg. The mean effective pressure in both cylinder is 7.5 bar. Determine indicated thermal efficiency if clearance volume is 15% of swept volume. | <b>07</b> |
|--|-----------|

- Q.3**
- |   |           |
|---|-----------|
| (a) Explain physical properties of engineering materials.   | <b>03</b> |
| (b) Efficiency of Carnot cycle is independent of working fluid justify.   | <b>04</b> |
| (c) The initial volume of 0.9 kg of a certain gas was 0.75 m <sup>3</sup> at a temperature of 15 <sup>0</sup> C and a pressure of 1 bar. After adiabatic compression the volume is reduce to 0.28 m <sup>3</sup> and pressure was found to be 4 bar. Calculate (1) gas constant (2) molecular mass if $R_0 = 8314.3 \text{ J/kg mol K}$ , (3) ratio of specific heats (4) $C_p$ and $C_v$ (5) change in internal energy | <b>07</b> |

**OR**

- Q.3**
- |   |           |
|---|-----------|
| (a) What is thermal prime mover? Why they are most important prime movers?                        | <b>03</b> |
| (b) What are nonferrous metals? Name any five and state their application.                        | <b>04</b> |
| (c) Explain with neat sketch throttling calorimeter. Also state its advantages and disadvantages. | <b>07</b> |

- Q.4**
- |   |           |
|---|-----------|
| (a) What is clutch? State its functions.                              | <b>03</b> |
| (b) What is refrigerant? Describe the properties of good refrigerant. | <b>04</b> |

- (c) A cylindrical vessel of 1 m diameter and 4 m length has hydrogen gas at pressure of 100 KPa and 27<sup>0</sup> C. Determine the amount of heat to be supplied so as to increase gas pressure to 125 KPa. For hydrogen take  $C_p = 14.307 \text{ KJ/Kg K}$ ,  $C_v = 10.183 \text{ KJ/Kg K}$ . **07**

**OR**

- Q.4** (a) What is the difference between rigid coupling and flexible coupling? **03**  
 (b) What is priming? Why priming is required in centrifugal pump but not in reciprocating pump? **04**  
 (c) Air is to be compressed in a single acting reciprocating compressor from 1.013 bar and 150 C to 7 bar. Calculate the indicated power required for free air delivery of 0.3 m<sup>3</sup>/min. when the compression process is 1. Isentropic 2. Reversible isothermal 3. polytropic with  $n = 1.25$ . **07**

- Q.5** (a) Explain 1 ton of refrigeration and refrigeration effect. **03**  
 (b) What are the advantages and disadvantages of water tube boiler over fire tube boiler? **04**  
 (c) Explain construction and working of Babcock and Wilcox boiler with line diagram **07**

**OR**

- Q.5** (a) Economizer used to increase efficiency of boiler justify this statement. **03**  
 (b) What are the differences between reciprocating and rotary compressor? **04**  
 (c) Determine the efficiency of air standard Carnot cycle with the following data **07**

Minimum temperature of the cycle = 27<sup>0</sup> C

Minimum pressure in the cycle = 1 bar

Pressure after isothermal compression = 4.5 bar

Pressure after isentropic compression = 12 bar

Take  $R = 0.287 \text{ KJ/kg K}$ .

Determine also power produced if engine makes 3 cycle/sec.

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