

C.U.SHAH UNIVERSITY

Summer Examination-2019

Subject Name: Elements of Mechanical Engineering

Subject Code: 4TE01EME1

Branch: B.Tech (All)

Semester: 1

Date: 19/03/2019

Time: 02:30 To 05:30

Marks: 70

Instructions:

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
- (2) Instructions written on main answer book are strictly to be obeyed.
- (3) Draw neat diagrams and figures (if necessary) at right places.
- (4) Assume suitable data if needed.

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|------------|---|-------------|
| Q-1 | Attempt the following questions: | (14) |
| | (a) What is non-flow process? | 01 |
| | (b) Define Dryness fraction. | 01 |
| | (c) Distinguish between heat and work. | 01 |
| | (d) State the zeroth law of thermodynamics. | 01 |
| | (e) Give the uses of compressed air. | 01 |
| | (f) What is refrigerating effect? | 01 |
| | (g) Which type of brake is widely used in automobiles? | 01 |
| | (h) For same compression ratio, the thermal efficiency of otto cycle is.....diesel cycle. | 01 |
| | (i) What is the average overall thermal efficiency of diesel engine? | 01 |
| | (j) Distinguish between gas and Vapor. | 01 |
| | (k) Write the applications of First law of thermodynamics. | 01 |
| | (l) List various mountings and accessories used in boiler. | 01 |
| | (m) List the essential components of heat engine. | 01 |
| | (n) State the limitation of Carnot cycle. | 01 |

Attempt any four questions from Q-2 to Q-8

| | | |
|------------|---|-------------|
| Q-2 | Attempt all questions | (14) |
| | a) What are the various forms of energy? List the nonconventional sources of energy. | 04 |
| | b) Explain throttling Calorimeter with neat sketch. | 04 |
| | c) With neat sketch explain construction and working of pressure gauge. | 06 |
| Q-3 | Attempt all questions | (14) |
| | a) The initial volume of 0.9 kg of a certain gas was 0.75 m^3 at a temperature of 15°C and a pressure of 1 bar. After adiabatic compression, the volume is reduced to 0.28 m^3 and pressure was found to be 4 bar. Take Gas constant $R = 289.352 \text{ J/kg K}$. Calculate: (i) C_p and C_v (ii) change in internal energy | 07 |
| | b) Discuss various types of non-flow processes and derive $PV^\gamma = \text{constant}$, Where $\gamma = C_p/C_v$ | 07 |
| Q-4 | Attempt all questions | (14) |



- a) What is difference between water tube and fire tube boiler? Explain with neat sketch any one water tube boiler. **07**
- b) Discuss briefly Otto cycle with the help of P-V diagram and derive an expression for the ideal efficiency of Otto cycle. **07**

Q-5 Attempt all questions (14)

- a) Write short note on gear drive. **04**
- b) Define the following with formula: **04**
- (i) Compression Ratio
 - (ii) Coefficient of Performance
 - (iii) Slip
 - (iv) Free Air Delivery
- c) Give the classification of Governing system. Explain with neat sketch Porter governor. **06**

Q-6 Attempt all questions (14)

- a) During testing of single cylinder two stroke oil engines, following data were obtained. **07**
 Brake torque = 640 N-m, cylinder diameter = 21 cm, speed = 350 rpm, stroke = 28 cm, mean effective pressure = 5.6 bar, oil consumption = 8.16 kJ/hr, calorific value = 42705 kJ/kg. Determine:
- (i) mechanical efficiency
 - (ii) indicated thermal efficiency
 - (iii) brake thermal efficiency
 - (iv) specific fuel consumption.
- b) What is the function of a pump? Explain with neat sketch, working of centrifugal pump. **07**

Q-7 Attempt all questions (14)

- a) 1 kg of air at 7 bar pressure and 90° C temperature undergoes a non-flow polytropic process. The law of expansion is $pV^{1.1} = \text{constant}$. The pressure falls to 1.4 bar during the process. Calculate : (1) Final temperature (2) Work done (3) Change in internal energy (4) Heat exchange **07**
 Take $R = 287 \text{ J/kg K}$ and $\gamma = 1.4$ for air.
- b) Explain with neat sketch construction and working of vane type compressor. **04**
- c) Differentiate between brake and clutch. Explain Band brake. **03**

Q-8 Attempt all questions (14)

- a) Classify various types of coupling and explain Oldham coupling with neat sketch. **07**
- b) Explain in detail vapor compression refrigeration system with sketch. **07**

