

**C.U.SHAH UNIVERSITY****Summer Examination-2017****Subject Name: Elements of Mechanical Engineering****Subject Code: 4TE01EME1****Branch: B.Tech (All)****Semester: 1****Date: 28/03/2017****Time:10:30 To 1:30****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) Compressor & Turbine is an example of (01)  
(a) Open system (b) Closed system (c) Isolated system (d) All of these (e) None
  - b) Wetness fraction of steam is equal to (a)  $x-1$  (b)  $x$  (c)  $1-x$  (d)  $1$  (e)  $0$  (01)
  - c) In the engine, working on diesel cycle, the heat is supplied at (01)  
(a) Constant temperature (b) Constant volume (c) Constant pressure (d) Constant heat (e) None
  - d) Babcock & Wilcox boiler is a type of .....boiler. (01)  
(a) Fire tube (b) Low pressure (c) Water tube (d) Vertical tube (e) All of these
  - e) The chemical formula of Freon 12 (R12) is (01)  
(a)  $CCl_2F_2$  (b)  $CClF_3$  (c)  $CCl_2F$  (d)  $CHClF_2$
  - f) The clearance ratio is defined as the ratio of (01)  
(a) clearance volume to cylinder volume (b) swept volume to clearance volume  
(c) clearance volume to swept volume (d) cylinder volume to clearance volume
  - g) Heat is rejected by a refrigerant during a refrigeration cycle in a (01)  
(a) Evaporator (b) Condenser (c) Throttle Valve (d) Compressor
  - h) The type of brake widely used in automobiles is (01)  
(a) Cone brake (b) Centrifugal brake (c) Internal expanding shoe brake (d) Simple band brake
  - i) The average overall thermal efficiency of diesel engine is (01)  
(a) 15 % (b) 76 % (c) 65 % (d) 36 % (e) 50 %
  - j) Absolute zero temperature is..... $^{\circ}C$  (01)  
(a) 0 (b) 273 (c) -273 (d) 100
  - k) The efficiency of carnot cycle is (01)  
(a)  $1-T_1/T_2$  (b)  $1- T_2/T_1$  (c)  $1+T_1/T_2$  (d)  $1+ T_2/T_1$
  - l) The performance of a boiler is measures by (01)  
(a) Amount of water evaporated/hr (b) Steam produced in kg/hr (c) All of these  
(d) None of these
  - m) For same compression ratio, the thermal efficiency of otto cycle is.....diesel cycle. (01)  
(a) Greater than (b) Less than (c) Equal to (d) Not depends on (e) Two times



- n)  $C_p - C_v$  is equal to (a) 0 (b) n (c) R (d)  $R_v$  (e)  $\gamma$  (01)

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

**Q-2**

**Attempt all questions**

- a) Explain Zeroth law of thermodynamics and First law of thermodynamics & write the limitations & applications of First law of thermodynamics. (07)
- b) Discuss various types of non-flow processes and derive  $PV^\gamma = \text{constant}$ , where  $\gamma = C_p/C_v$  (07)

**Q-3**

**Attempt all questions**

- a) Define dryness and wetness fraction of steam and explain with neat sketch any one type calorimeter used for the measurement of dryness fraction. (07)
- b) Steam at 8 bar and dryness of 0.9 expand at constant pressure until the dryness fraction is 0.6. calculate the work done and heat removed per kg of steam during the process. (From steam table at 8 bar,  $h_{f1} = h_{f2} = 720.94$  KJ/Kg,  $h_{fg1} = 2046.5$  KJ/Kg,  $v_{g1} = v_{g2} = 0.24026$  m<sup>3</sup>/Kg) (07)

**Q-4**

**Attempt all questions**

- a) Discuss briefly Otto cycle with the help of P-V diagram and derive an expression for the ideal efficiency of Otto cycle. (07)
- b) In an air standard Otto cycle the maximum and minimum temperatures are 1400 °C and 15 °C. The supplied per kg of air is 800 kJ. Calculate the compression ratio and cycle efficiency. Take  $C_v = 0.718$  kJ/kg-K,  $\gamma = 1.4$  (07)

**Q-5**

**Attempt all questions**

- a) Differentiate between fire tube boiler & water tube boiler with examples & write advantages of water tube boiler over fire tube boiler. (07)
- b) List various mountings and accessories and explain any one mounting with neat labelled diagram. (07)

**Q-6**

**Attempt all questions**

- a) Write the comparison between two stroke and four stroke cycle engines. (07)
- b) During testing of single cylinder two stroke oil engine, 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.

**Q-7**

**Attempt all question**

- a) Explain types of governing of I C engine. (07)
- b) What is the function of a pump? Explain with neat sketch, working of centrifugal Pump. (07)

**Q-8**

**Attempt all questions**

- a) Classify various types of coupling and explain Oldham coupling with neat sketch. (07)
- b) Define refrigeration and types of refrigerant and explain with a neat sketch, describe the working of vapour compression refrigeration. (07)

