G.R. No.	

Paper code – U219-155 (BE-F & FS.)

DECEMBER 2019/ENDSEM – Backlog Exam

S. Y. B. TECH. (MECHANICAL ENGINEERING) (SEMESTER - I)

COURSE NAME : THERMODYNAMICS

COURSE CODE : MEUA21175

(PATTERN 2017)

Time: [2 Hours]   [Max. Marks: 50]

(*) **Instructions to candidates:**
1) Answer Q.1, Q.2, Q.3, Q.4, Q.5 OR Q.6, Q.7 OR Q.8
2) Figures to the right indicate full marks
3) Use of Steam Table, Mollier Diagram is allowed
4) Use of scientific calculator is allowed
5) Use suitable data where ever required

Q.1 a) Derive relationship to determine work done & heat transfer for Isothermal Process.   **6**

OR

b) 0.3 kg of nitrogen gas at 100 kPa and 40 °C is contained in a cylinder. The piston is moved compressing nitrogen until the pressure becomes 1 MPa and temperature becomes 160 °C. The work done during the process is 30 kJ. Calculate the heat transferred from the nitrogen to the surroundings.   **6**

Q.2 a) State following terms
     i.   Clausius statement
     ii. Kelvin Plank statement   **6**

OR

b) Explain Clausius inequality.   **6**

Q.3 a) 0.04 m³ of nitrogen contained in a cylinder behind a piston is initially at 1.05 bar and 15 °C. The gas is compressed isothermally and reversibly until the pressure is 4.8 bar.
Calculate:
(i) The change of entropy,
(ii) The heat flow, and
(iii) The work done.   **6**

OR

b) Explain the concept of available and unavailable energy.   **6**

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Q.4 **a)** Explain the following terms relating to steam formation
- (i)   Sensible heat of water,
- (ii) Latent heat of steam,
- (iii) Enthalpy of wet steam.   **4**

OR

b) What is Superheated steam. List advantages of superheated steam if it is used in steam prime movers?   **4**

Q.5 **a)** 5400 kg of steam is produced per hour at a pressure of 750 kPa in a boiler when feed water is at 41.5 °C. The dryness fraction of the steam is 0.98. The amount of the coal burnt per hour is 670 kg with CV of 31000 KJ/Kg. Determine the boiler efficiency and equivalent evaporation.   **6**
b) What is a steam generator? How they are classified?   **4**
c) Describe with neat sketch, fusible plug for a boiler.   **4**

OR

Q.6 **a)** The following readings were recorded during boiler trial of 6 hour duration:
Pressure of steam generated 12 bar, mass of steam generated 40000 kg, dryness fraction of steam generated 0.85, feed water temperature 30 °C, coal used 4000 kg, CV of coal 33400 KJ/Kg, Find:
- i)   factor of equivalent evaporation
- ii) Equivalent evaporation from and at 100 °C,
- iii) Efficiency of boiler.   **6**
b) Discuss the working of an economizer in boiler with neat sketch. **4**
c) Enlist various heat losses in boiler. Which is the biggest loss?   **4**

Q.7 **a)** A single stage reciprocating air compressor takes in 7.5 m³/min of air at 1 bar and 30 °C and delivers it at 5 bar. The clearance is 5% of stroke. The expansion and compression are polytropic, n = 1.3 Calculate:
- i)   The temperature of delivered air
- ii) Power of compressor   **6**
b) Describe working of a single stage reciprocating air compressor. **4**
c) Explain the following terms: a. Isothermal efficiency b. Volumetric efficiency   **4**

OR

Q.8 **a)** Find the percentage saving in work by compressing air in two stages from 1 bar to 7 bar instead one stage. Assume compression index 1.35 in both the cases and optimum pressure and complete intercooling in two stage compressors.   **6**
b) Derive the expression for the polytropic work done by reciprocating compressor with clearance volume.   **4**
c) What are the advantages of multi-staging in reciprocating air compressor?   **4**

**********Best of Luck**********

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