Hall Ticket Number:

Code No. : 13517 O2

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E (Mech. Engg.: CBCS) III-Semester Backlog (Old) Examinations, December 2018

Thermodynamics

Time: 3 hours Max. Marks: 70

*Note: Answer **ALL** questions in **Part-A** and any **FIVE** questions from **Part-B***

Part-A (10 × 2=20 Marks)

1. What are *extensive* and *intensive* properties? Give *examples*.
2. Explain *zeroth law* of thermodynamics.
3. Provide an example where there is *no work done in spite of volume change*.
4. Derive the steady flow energy equation for a *diffuser*.
5. State *Carnot theorem*.
6. Calculate the change in entropy if *1 kg* of *saturated liquid* at *30°C* is converted into *superheated steam* at *1 bar* and *200°C*.
7. Draw the *p-T* (phase) *diagram* for water.
8. Define dryness portion of Steam.
9. State Daltons law of partial pressure.
10. Draw *p-v* and *T-s* diagrams for *Dual cycle*.

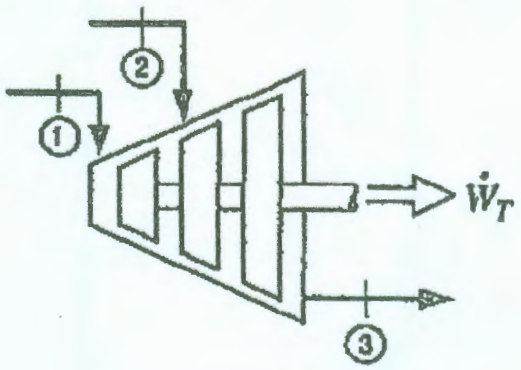
Part-B (5 × 10=50 Marks)

11. a) Explain the working of a *constant pressure ideal gas thermometer* with a neat sketch. [7]

    b) What do you understand by *fixed point?* State the *standard fixed point* of thermometry. [3]

12. a) Derive the steady flow energy equation for a *throttling valve*. [4]

    b) A steam turbine receives steam from two boilers as shown in the figure. One flow is *5 kg/s* at *3 MPa* and *700°C*, and the other flow is *15 kg/s* at *800 kPa* and *500°C*. The exit state is *10 kPa*, with a quality of *96%*. Find the *total power output* of the *adiabatic* turbine. [6]



Contd... 2

13. a) Prove the *equivalence* of *Kelvin-Planck* and *Clausius* statements. [6]

b) A heat engine receives half of its heat at a temperature of *1000 K* and the rest at *500 K* while rejecting heat to a sink at *300 K*. What is the *maximum* possible thermal efficiency? [4]

14. a) What is *Clapeyron equation*? Provide the *assumptions* involved. [5]

b) A rigid tank contains *10 kg* of water at *90°C*. If *8 kg* of the water is in the liquid form and the rest is in the vapour form, determine (i) the *pressure* in the tank and (ii) the *volume* of the tank [5]

15. a) Derive the *work done* and *thermal efficiency* of *Diesel* cycle in terms of cut-off ratio and compression ratio. [6]

b) In a *Diesel* cycle, the compression ratio is *15*. The compression begins at *0.1 MPa, 40°C* while the heat added is *1.675 MJ/kg*. Find (i) the *maximum temperature* in the cycle, (ii) *work done per kg of air* (iii) the *cycle efficiency* (iv) the *temperature* at the end of the isentropic expansion, and (v) the *cut-off ratio*. [4]

16. a) Distinguish between *classical thermodynamics* and *statistical thermodynamics* by referring to examples. [5]

b) A mass of *1.5 kg* of air is compressed in a quasi-static process in a piston-cylinder from *0.1 MPa* to *0.7 MPa* following the law pv=c. The initial density of air is *1.16 kg/m^3*. Find the *work done* by the piston to compress the air. [5]

17. Answer any ***two*** of the following:

a) State and prove *Clausius* theorem. [5]

b) A glass jar is filled with saturated water at *500 kPa* of *25%* quality with a tight lid put on is cooled to *-10°C*. What is the *mass fraction* of solid at this temperature? [5]

c) Derive the relationship between *volumetric analysis* and *gravimetric analysis*. [5]

*****