



M 18983

Reg. No. :

Name :

**VIII Semester B.Tech. (Reg./Supple./Imp.) including Part Time Degree
Examination, April 2011
(2007 Admn.)
MECHANICAL ENGG.
PT2K6/2K6ME 801 : Gas Dynamics**

Time: 3 Hours

Max. Marks: 100

*Instruction : Thermodynamics/steam/compressible flow tables allowed for
the Examination.*

Answer **all** questions :

I. Answer the following questions briefly :

(5×8=40)

- 1) Deduce the relationship between static temperature and stagnation temperature from SFEE for a compressible flow.
- 2) Does sound travel faster in winter or summer ? Explain by taking a representative temperature in each case.
- 3) Explain physically when choked flow occurs in a nozzle.
- 4) Sketch and explain area change for a nozzle undergoing subsonic and supersonic flow conditions.
- 5) Explain the difference between normal and oblique shocks with neat sketches.
- 6) Sketch and explain T-S diagram for a normal shock wave.
- 7) Sketch and explain Rayleigh and Fanno lines on a h-s diagram for flow across a normal shock.
- 8) Heat addition to a gas may some times cool the gas. Explain with proper h-s diagram.

P.T.O.



- II. A) 1) Derive an expression for sonic velocity through a compressible medium undergoing isentropic flow : 9
- 2) A supersonic jet cruising at 1 km elevation above you moves past in a flyby. How many seconds after the plane passes overhead do you expect to wait before you could hear the aircraft, if it is moving with a Mach number of 1.5 and the ambient temperature is 20°C. 6

OR

- B) 1) Sketch and explain the meaning of isentropic and actual stagnation pressures on a neat h-s diagram for flow through a compressor stage. 6
- 2) An aircraft is flying at a cruising speed of 250 m/s at an altitude of 5 km where the atmospheric pressure is 54.05 kPa and the ambient air temperature is 255.7 K. The ambient air is first decelerated in a diffuser before it enters the compressor. Assuming both the diffuser and the compressor to be isentropic, determine the stagnation pressure at the compressor inlet and the required compressor specific work, if the stagnation pressure ratio of the compressor is 8. 9

- III. A) 1) Derive with usual notations for flow through an isentropic nozzle/diffuser the expression for area change with Mach Number given by,

$$\frac{dA}{A} = \frac{dV}{V} (1 - M^2).$$

7

- 2) The isentropic converging – diverging nozzle has an exit area 0.004 m² and a throat area of 0.001 m². It is attached to a reservoir with a temperature of 20°C and pressure of 500 kPa. Determine the two exit pressures that result in M = 1 at the throat. Also determine the associated exit temperature and velocities. 8

OR



- B) 1) Show that for an isentropic flow through a nozzle/diffuser, the critical mass flow rate is given by,

$$\dot{m} = p_0 A \frac{\delta y}{\delta x} \sqrt{\frac{k}{RT_0}} \left[\frac{k+1}{2} \right]^{\frac{k+1}{2(1-k)}} \quad 9$$

- 2) The nozzle in an impulse stage of a gas turbine is required to expand the working fluid from 4.4 bar and 760°C to 1.2 bar. Find the throat diameter, exit diameter and outlet temperature for a mass flow rate of 1800 kg/hr. Take the nozzle isentropic efficiency as 85% and the working fluid has $\gamma = 1.4$. 6

- IV. A) 1) Derive the Hugoniot equation for a normal shock. 6

- 2) A converging – diverging nozzle has an exit area to throat area ratio of 2.5. The total properties of air at inlet are 7 bar and 87°C. The throat area is 650 mm². Determine the exit Mach Number, static pressure, static temperature and stagnation pressure when a plane normal shock stands at a point where $M = 2$. Assume isentropic flow till shock occurs. Take $\gamma = 1.4$ 9

OR

- B) 1) Show that across a normal shock, the temperature ratio is given by,

$$\frac{T_2}{T_1} = \frac{\left(1 + \frac{k-1}{2} M_1^2\right) \left(\frac{2k}{k-1} M_1^2 - 1\right)}{\left(\frac{(k+1)^2}{2(k-1)} M_1^2\right)} \quad 9$$

- 2) A compression shock occurs in a divergent flow passage. On the upstream side of the shock, the velocity of the air is 400 m/s and is at 2 bar and 35°C. Determine the Mach number on the downstream side of the shock wave and the corresponding air velocity and change in entropy as a result of shock. Take $\gamma = 1.4$. 6



- V. A) 1) Compare the flows through a constant area duct for isentropic and adiabatic conditions. 6
- 2) Air is flowing at a constant temperature through a 75 mm diameter horizontal pipe ($f = 0.02$). At entrance, the velocity of air is 100 m/s, temperature is 50°C and pressure is 2.04 bar. What is the max. pipe length for this flow and how much heat is transferred to the air per kg of air? 9
- OR
- B) 1) Show that the point of max. entropy on the Fanno line for the adiabatic steady flow of a fluid in a duct corresponds to the sonic velocity. 9
- 2) Air is heated in a constant area duct. The inlet Mach number is 0.2 and the exit Mach number is 0.8. The inlet conditions are 2 bar and 92°C . Neglecting friction, what are the exit stagnation conditions corresponding to pressure and temperature. Take $\gamma = 1.4$. 6
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M 18984

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**VIII Semester B.Tech. (Reg./Sup./Imp.) Including Part Time Degree
Examination, April 2011
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MECHANICAL ENGINEERING

PT2K6/2K6ME 802 – Refrigeration and Airconditioning

Time: 3 Hours

Max. Marks : 100

- I. i) How actual vapor compression refrigeration, system differs from theoretical system ? **5**
- ii) Define the terms :
- a) Coefficient of performance
 - b) Ton of refrigeration
 - c) Subcooling
 - d) Throttling expansion
 - e) Heat pump. **5**
- iii) With a neat sketch explain the working of a steam jet refrigeration system. **5**
- iv) State the merits and demerits of air refrigeration system. **5**
- v) List and explain five important desired properties of refrigerant in vapor compression system. **5**
- vi) Obtain an expression for volumetric efficiency of a reciprocating air compressor in terms of clearance ratio and pressure ratio. **5**
- vii) List and briefly explain five important components of internal heat gains. **5**

P.T.O.



viii) Define :

- a) Saturated air
- b) Dry bulb temperature
- c) Dewpoint temp
- d) Relative humidity
- e) Specific humidity.

5

II. A) i) With neat sketches (flow of P-h diagrams) obtain an expression for theoretical COP of vapor compression system.

5

- ii) A simple ammonia-compression system operates with capacity of 150 tonnes. The condensation temperature in the condenser is 35°C . The evaporation temperature in the evaporator is -25°C . The ammonia leaves the evaporator and enters the compressor at -8°C . Ammonia enters the expansion valve at 30°C . Pressure drop through compressor values

Suction = 0.118 bar discharge = 0.23 bar

Compression index = 1.22 Volumetric eff = 0.75.

Calculate :

- i) Power
- ii) COP
- iii) Piston displacement
- iv) Heat transfer in condenser.

10

OR

B) i) Explain basic principle of thermoelectric refrigeration system.

5

- ii) A food storage locker requires a refrigeration capacity of 50kW. It works between a condenser temperature of 35°C and an evaporator temperature of -10°C . Refrigerant is NH_3 . It is subcooled by 5°C before entering the expansion valve. Refrigerant leaving the evaporator is dry saturated. Assuming single cylinder single acting compressor operating at 1000 rpm with stroke to bore ratio equal to 1.2, determine :

- i) Power required
- ii) The cylinder dimensions.

10



III. A) i) What are the difference between vapor compression and vapor absorption refrigeration system (three important diff). 5

ii) An aircraft refrigeration plant has to handle acabin load of 30 tonnes. The atmospheric temperature is 17°C. The atmospheric air is compressed to a pressure of 0.95 bar and temperature of 30°C due to ram action. This air is then further compressed in a compressor to 4.75 bar, cooled in a heat exchanger to 67°C, expanded in a turbine to 1 bar pressure and supplied to the cabin. Air leaves the cabin at a temperature of 27°C. Isentropic efficiency of compressor and turbin are 0.9 each calculate the mass of air circulated her minute and COP. Take

$$C_{p\text{air}} = 1.004 \text{ kJ/kgk} \text{ and } \frac{C_p}{C_v} = \gamma = 1.4. \quad 10$$

OR

B) i) Compare acqua ammonia and lithium bromid water refrigeration system. 7

ii) Obtain an expression for COP of Bell Coleman cycle by considering compressor and expander efficiencies as 100%. Clearly write flow diagram as well as PV and T-S diagram. 8

IV. A) i) What is the function of condenser ? List the types of condenser and explain any one of them. 8

ii) Why intercooling is necessary in multistage compressors ? What are the advantages of multistage compressors our single stage compressors ? 7

OR

B) i) Write a short note on ozone depletion and global warming potential of CFC refrigerants. 8

ii) Compare flooded and dry type evaporators. 7



- V. A) i) What do you mean by adiabatic saturation ? Explain adiabatic saturation process using flow diagram as well as T-S diagram. 7
- ii) A 2 ton cooling unit is used to dehumidify $0.2 \text{ m}^3/\text{s}$ from $T_{\text{db}} = 28^\circ\text{C}$ $T_{\text{wb}} = 25^\circ\text{C}$ to specific humidity level of $W_2 = 0.008 \text{ kg w/kg of d.a.}$
- Determine :
- a) T_{db} and Dew point temp. of air at exit condition and
- b) Amount of dehumidification. (Don't use psychrometric chart). 8

OR

- B) i) List and explain the methods used to remove moisture from air. 7
- ii) Moist air enters a chamber at 5°C dbt and 2.5°C thermodynamic wet bulb temp. at a rate of 90 cmm . The barometric pressure is 1.01325 bar while passing through the chamber the air absorbs sensible heat at a rate of 40.7 kW and picks up 40 kg/hr of saturated steam at 110°C .
- Determine the dry bulb and wet bulb temp. of air and change in enthalpy. 8
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M 18985

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Examination, April 2011
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MECHANICAL ENGINEERING
PT 2K6/2K6 ME803 : Machine Design – II

Time: 3 Hours

Max. Marks: 100

*Instruction: Machine Design Data Handbook, Vol. – I and Vol. – II
Lingaiah may be permitted.*

- I. 1. a) Derive an expression for the torque transmitting capacity of a single plate clutch using uniform pressure theory. 5
1. b) List the assumptions and derive an expression for the actuating force in a block brake. 5
2. a) List the assumptions and derive Lewis equation. 5
2. b) Explain the force analysis of helical gear. 5
3. a) Derive Petroff's equation. 5
3. b) Explain the classification of Rolling Contact Bearings. 5
4. a) Explain the design recommendations for rolled sections. 5
4. b) Explain the design recommendations for screw-machine products. 5
- II. 1. A) a) A multiple plate clutch of alternate bronze and steel plates is to transmit 6 kW power at 800 rpm. The inner radius of contact is 38 mm and the outer radius is 70 mm. The co-efficient of friction is 0.1 and the maximum allowable pressure is 350 kN/m². Determine the following :
- 1) Axial force required
- 2) Total number of discs
- 3) Average pressure and
- 4) Actual maximum pressure. 8

P.T.O.



- b) A simple band brake operates on a drum 0.6 m in diameter rotating at 200 rpm. The co-efficient of friction is 0.25 and the angle of contact of the band is 270° . One end of the band is fastened to a fixed pin and the other end to 125 mm from the fixed pin. The brake arm is 750 mm long. 7

OR

1. B) a) A single plate friction clutch of both sides effective has 0.3 m outer diameter and 0.16 m inside diameter. The co-efficient of friction is 0.2 and it runs at 1000 rpm. Find the power transmitted for uniform wear and uniform pressure distribution cases if the allowable maximum pressure is 0.08 MPa. 8
- b) A differential band brake has an operating lever 2.25 m long. The ends of the brake band are attached so that their operating arms are 38 mm and 127 mm long. The brake drum diameter is 600 mm, the arc of contact is 300° , the co-efficient of friction is 0.22 and the band is 3.2 mm \times 100 mm. 7
- III. 1. A) A cast steel pinion rotating at 600 rpm drives a bronze spur gear. The speed ratio is 4 : 1 and the module is 6 mm. The pinion has 16 teeth of 20° full depth involute profile. The face width of both gears is 75 mm. Determine the power that can be transmitted from the strength point. 15

OR

1. B) a) A pair of carefully cut, full depth 20° involute gears, made of phosphor gear bronze is transmitting 3.75 kW power at 1150 rpm of the pinion. The module is 3 mm and the face width of gear 38 mm. The number of teeth on pinion and gear are 24 and 32 respectively. Determine :
- 1) Dynamic load
 - 2) Endurance strength
 - 3) Wear load for 300 Hg. 8
- b) A hardened steel worm rotating at 1200 rpm transmits power to a phosphor bronze gear ($\sigma_0 = 55 \text{ MN/m}^2$) with a transmission ratio of 15 to 1. The center distance is 200 mm. Determine the power input rating from stand point of strength. 7



IV. 1. A) A bronze backed babbitt bearing and a hardened steel journal is used to support a load of 4.5 kN at 600 rpm. An abundance of oil is supplied by means of oiling rings. The lubricant used is the ring oiled bearing oil and its operating temperature is 80° C. The bearing is relieved for 20° from the normal to the load line. Determine :

- i) Length of bearing
- ii) Diameter of journal
- iii) Co-efficient of friction by Mckee's equation
- iv) Heat generated by friction
- v) Heat dissipated by the bearing
- vi) Sommerfeld number and
- vii) Minimum film thickness.

15

OR

B) Select a single row deep groove ball bearing for the lower bearing B of the vertical shaft of diameter 30 mm, shown in fig. 1. The shaft is driven by a belt drive and the resultant force acting on the pulley is 4 kN. The thrust acting on the lower bearing is 1.2 kN. Base the selection for a life of 5000 hours. The shaft rotates at 400 rpm. Take the service factor as 1.5 for minor shock loads.

15

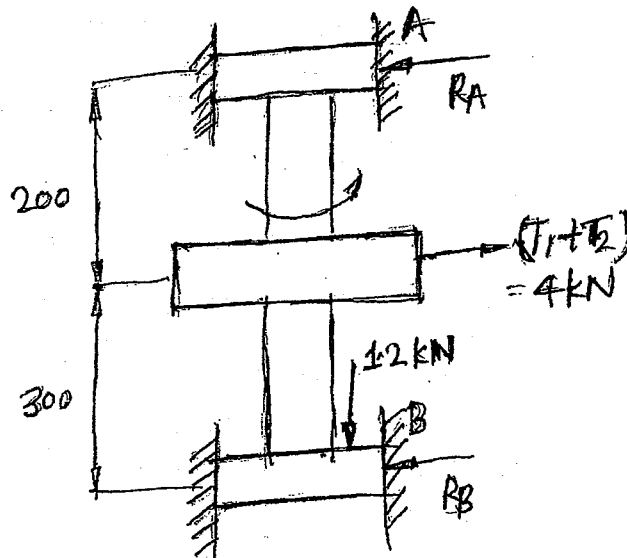


Fig. 1

V. 1. A) Explain the design recommendation for machined round holes.

15

OR

1. B) Explain the design recommendation for welded parts.

15



M 19351

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Examination, April 2011
(2007 Admn.)**

PT2K6/2K6ME 804 : Inventory and Supply Chain Management

Time : 3 Hours

Max. Marks : 100

Instruction : Answer all questions.

- I. a) Write short note on various decision phases in Supply Chain Management (SCM).
b) Differentiate between logistics and SCM.
c) Explain ABC analysis.
d) Why inventories are maintained ? What are the various types of inventories ?
e) Explain quantity discount concept.
f) Write short note on Sensitivity analysis.
g) Briefly explain (DRP) Distribution Requirement Planning.
h) Write down the algorithm for solving inventory problem using Wagner-Whitin method. **(8×5=40)**
- II. a) What are the objectives of SCM ? Explain any one supply chain model. **15**
- OR
- b) Explain any three supply chain management performance measuring systems. **15**

P.T.O.



III. a) Briefly explain the steps adopted for effective purchasing. 15

OR

b) i) Explain the methods involved in Vendor rating. 8

ii) Using a sketch explain the terms involved in an inventory problem. 7

IV. a) Compute the relationship for economic order quantity and optimum shortages for a manufacturing inventory model with shortage. 15

OR

b) Determine the economic order quantity for the following situation. 15

Annual demand = 10,000 units, Ordering cost Rs. 28.80, Carrying cost per unit per year = 20% of the unit price. The quantity versus unit price schedule is

0 to 9,999 – Rs. 2.00

10,000 to 19,999 – Rs. 1.60

20,000 and above – Rs. 1.40

V. a) Briefly explain the features and benefits of implementing the following systems in a manufacturing unit. (i) Just in time (ii) Kanban. (8+7=15)

OR

b) Define dynamic inventory models. Explain Q systems and P systems of inventory control. 15



M 19046

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**VIII Semester B.Tech. (Reg./Sup./Imp.) including Part Time Degree
Examination, April 2011
PT2K6/2K6ME 805 (E) : MECHANICAL ENGINEERING
Quality Engineering and Management
(2007 Admn.)**

Time: 3 Hours

Max. Marks: 100

Instructions : 1) Answer all questions.

2) Use of SQC Tables permitted.

3) Missing data if any, may be assumed suitably.

- I. 1) How is total quality different from traditional ways of doing business ?
2) Explain "The Juron Trilogy".
3) Write a note on "Run Charts".
4) How customer needs are identified ?
5) Explain the Rationale for continuous improvement.
6) Explain process capability.
7) Distinguish between type I and type II errors with regard to control chart analysis.
8) Differentiate between producer's risk and consumer's risk. (5×8=40)
- II. A) 1) Explain Philip F Crosby's contributions to quality. 7
2) Explain the steps involved in writing the broad strategic objectives. 8
- OR
- B) 1) Explain "The Total Quality Model" for achievement of total quality. 8
2) Explain the Deming's "seven Deadly diseases" Which are to be eliminated to achieve world-class quality ? 7

P.T.O.

