



6TH Semester End Term Examination: 2021-22.

Subject : **Professional Practice, Law & Ethics** Roll No:

Course : **BT ME**

Full Marks : **70**

Time: 3 Hours.

Instructions to the Candidates:

- Read the question paper very carefully.
- Start writing from 2nd page onwards; **don't Write On The 1st Page Backside.**
- Question Paper is divided into Three Parts -A, B & C.
- Part-A is containing 12 multiple choice questions.
- Part- B containing SIX questions out of which FOUR questions are to be answered.
- Part C containing FOUR questions out of which TWO questions are to be answered.
- Do not write anything except your Roll No. on the question paper.
- Possession of **Mobile Phones** or any kind of **Written Material, Arguments with the Invigilator or Discussing with Co-Student** will come under **Unfair Means** and will **Result** in the **Cancellation of the Papers.**

PART - A

Multiple Choice Questions

[12x1=12]

1. An agreement enforceable by law is:
a. Contract b. An Offer c. A Void Contract d. None
2. Every promise and every set of promises, forming the consideration for each other, is called as:
a. Avoidable contract. b. A contract c. A void contract d. An agreement
3. An agreement which is enforceable by law at the option of other or others is:
a. A Contract b. Voidable Contract c. Acceptance d. Fraud
4. The special provisions relating to Lay-off, retrenchment and closure as given under the Industrial Disputes Act, 1947 apply to those establishments where at least.
a. 100 workers are employed. c. 50 workers are employed.
b. 200 workers are employed. d. 500 workers are employed.

5. 'First come last go and last come first go' is the principle of.
 - a. Lay-off
 - b. Closure
 - c. Retrenchment
 - d. Dismissal
6. If there is wilful removal or disregard by the workman of any safety guard or other device which he knew to have been provided for the purpose of securing safety of workman.
 - a. Employer is liable to pay compensation
 - b. Employer is not liable to pay compensation
 - c. Appropriate government is liable to pay compensation
 - d. The Trade Union is liable to pay compensation
7. Under this Act, employer shall not be liable to pay compensation in respect of any injury which does not result in the total or partial disablement of the workman for a period exceeding --- days
 - a. 7 Days
 - b. 3 Days
 - c. 5 Days
 - d. 9 Days
8. A proposal upon acceptance becomes a
 - a. Promise
 - b. Contract
 - c. Agreement
 - d. Both B and C
9. A void contract is a contract which
 - a. Is not enforceable by law
 - b. Declared void by the Indian contract act
 - c. Does not have reasonable terms
 - d. Both A and C
10. When did The Industrial Employment (Standing Orders) Act 1946, come into force?
 - a. 01 April 1936
 - b. 01 March 1937
 - c. 01 May 1935
 - d. 23 April, 1946
11. Which section of The Industrial Employment (Standing Orders) Act 1946 deals with Posting of standing orders?
 - a. Section 12
 - b. Section 9
 - c. Section 14
 - d. Section 20
12. Consideration can be
 - a. Past
 - b. Present
 - c. Future
 - d. All of the Above

PART B

ANSWER ANY FOUR OUT OF SIX

(4x7=28)

1. What is a voidable contract under section 2(i) of Indian Contract Act?
2. Define the term contract. What are the essentials of a valid contract?
3. Distinguished between any one.
 - a. Express Contract and implied Contract.
 - b. Void Agreement and Voidable Contract.
4. Explain the concept of retrenchment with the help of example.
5. What do you mean by "Professional Ethics"? What are the difference between Profession and occupation?
6. Write down the brief introduction and need for the Real Estate Regulation Act, 2016?

PART C

ANSWER ANY TWO OUT OF FOUR

(2x15=30)

1. Who is a competent person to make a contract under section 11 of Indian Contract act?
2. Explain the following
 - a. Offer
 - b. Acceptance.
3. What is 'strike' and 'lockout'? When will it be termed as 'illegal'?
4. Write a short note on any two
 - a. Continues Service
 - b. Public Utility Service
 - c. Lock out



6TH Semester End Term Examination: 2021-22.

Subject : COMPOSIT MATERIAL **Roll No:**
Course : B.Tech ME
Full Marks : 70 **Time : 3 Hours.**

Instructions to the Candidates:

- Read the question paper very carefully.
- Start writing from 2nd page onwards; don't Write On The 1st Page Backside.
- Question Paper is divided into Three Parts -A, B & C.
- Part-A is containing 12 multiple choice questions.
- Part- B containing SIX questions out of which FOUR questions are to be answered.
- Part C containing FOUR questions out of which TWO questions are to be answered.
- Do not write anything except your Roll No. on the question paper.
- Possession of **Mobile Phones** or any kind of **Written Material, Arguments with the Invigilator or Discussing with Co-Student** will come under **Unfair Means** and will **Result** in the **Cancellation of the Papers.**

PART - A

Multiple Choice Questions

[12x1=12]

1. What factors are used to identify composite materials?
(a) Type of matrix (c) Size-and-shape of reinforcement
(b) (c) Both (d) None
2. In dispersion-strengthened composites, the main load carrier is
(a) Matrix (b) Fibber (c) Both (d) Can't define
3. The softer constituent of a composite is typically
(a) Matrix (b) Reinforcement (c) Both are of equal strength (d) Can't define
4. A composite's usually stronger constituent is
(a) Matrix (b) Reinforcement (c) Both are of equal strength (d) Can't define
5. In fibre reinforced composites, the last part to fail is the resin.
(a) Matrix (b) Fibber (c) Both fails at same time (d) Can't define
(b)

6. Size range of dispersions used in dispersion strengthened composites

- (a) 0.01-0.1 μm (b) 0.01-0.1 nm (c) 0.01-0.1 mm (d) None

7. Rule-of-mixture provides _____ bounds for mechanical properties of particulate composites.

- (a) Lower (b) Upper (c) Both (d) None

8. Al-alloys used in engines and car parts are strengthened to improve their

- (a) Strength (b) Wear resistance (c) Elastic modulus (d) Density

9. Mechanical properties of fiber-reinforced composites depend on

(a) Properties of constituents

(b) Interface strength

(c) Fiber length, orientation, and volume fraction

(d) All the above

10. The key factor that influences the longitudinal strength of a fibre reinforced composite is

(a) Fiber strength (b) Fiber orientation (c) fiber volume fraction (d) fiber length

11. The materials described below can be used to fill sandwich structures.

(a) Polymers (b) Cement (c) Wood (d) All

12. Not a good example of a laminar composite.

(a) Wood (b) Bimetallic (c) Coatings/Paints (d) Claddings

PART B

ANSWER ANY FOUR OUT OF SIX

(4x7=28)

1. Define composite material.
2. What is the need for composite material?
3. Mention important characteristics of composite material
4. Classify composite material.
5. List the characteristics of matrix material.
6. Write stiffness matrix for plane stress.

PART C

ANSWER ANY TWO OUT OF FOUR:

(2x15=30)

1. Define short fibre. Also derive critical fibre length for Short fibre ?
2. Explain Micro and Macro level damage mechanics in fibrous composite
3. What do you mean by Ceramic Matrix Composite also list out the various type of CMC
4. Define MMC, Its Properties, Application and Example.



ARKAJAIN
University
Jharkhand

6th Semester End Term Examination: 2021-22.

Subject : Introduction to Tribology **Roll No:**
Course : B.Tech ME
Full Marks : 70 **Time : 3 Hours.**

Instructions to the Candidates:

- Read the question paper very carefully.
- Start writing from 2nd page onwards; **don't write On The 1st Page Backside.**
- Question Paper is divided into Three Parts -A, B & C.
- Part-A is containing 12 multiple choice questions.
- Part- B containing SIX questions out of which FOUR questions are to be answered.
- Part C containing FOUR questions out of which TWO questions are to be answered.
- Do not write anything except your Roll No. on the question paper.
- Possession of **Mobile Phones** or any kind of **Written Material, Arguments with the Invigilator or Discussing with Co-Student** will come under **Unfair Means** and will **Result** in the **Cancellation of the Papers.**

PART - A

Multiple Choice Questions

[12x1=12]

1. The following is not a type of sliding contact bearing
a. Ball bearing b. Journal bearing c. Bush bearing d. Thrust bearing
2. Boundary friction conditions may develop in journal bearings, when shaft passes through zero speed during
a. Starting b. Stopping c. Reversing d. All of the above
3. In thrust bearings, the load acts
a. Perpendicular to the axis of shaft c. In axial direction
b. Both 'a' and 'b' d. None of the above
4. The Archard equation is useful because it provides a measure of
a. The severity of wear c. Viscosity index
b. Surface roughness d. The shear strength of a lubricant

5. The flash point of lubricant must be _____ the working temperature.
 a. Well below b. Well above c. Equal to d. None of the above
6. Lubricant converts
 a. Solid friction into liquid friction c. Liquid friction into solid friction
 b. Both 'a' and 'b' d. None of the above
7. Which one of the following statement is true?
 a. Wear rate increases with increasing load
 b. Wear rate decreases with increasing temperature.
 c. Wear rate decreases with increasing speed.
 d. Wear rate is independent of load/temperature.
8. Which one of the following statements is NOT true about friction?
 a. Friction is tangential resistance to motion.
 b. Friction is dependent upon the surface of the content.
 c. Friction is greater on rough surface.
 d. Friction does not decrease with lubrication.

9. The following is not a type of roller contact bearing
 a. Ball bearing c. Journal bearing
 b. Roller bearing d. All of the above
10. In thrust bearings, the load acts
 a. Perpendicular to the axis of shaft c. In axial direction
 b. Both 'a' and 'b' d. None of the above
11. For low pressure and low speeds, we use
 a. Mineral oils c. Semi-solid lubricants
 b. Solid lubricants d. All of the above
12. Asperities are basically
 a. Sharp tips on surface. c. Edge of a surface.
 b. Corner of a surface. d. Hole in a surface.

PART B

ANSWER ANY FOUR OUT OF SIX

(4x7=28)

- Under what circumstances does contact fatigue occur? What are the consequences arising out of this type of wear and how can it be limited?
- Explain the following a) Flash Point b) Fire Point c) Pour Point d) Viscosity Index
- Define wear and explain type of wear with sketches.
- Explain with sketches, the regimes of lubrication.
- Explain different methods of measurement of friction.
- Define Tribology. Discuss basic methods of solutions of tribological problems.

PART C

ANSWER ANY TWO OUT OF FOUR:

(2x15=30)

- Define the term friction. Explain the measurement of friction by pin on disc method.
- A hydrodynamic, 360° short journal bearing of l/d ratio 0.4 is to be designed to support a radial load of 5kN. The journal rotates at 5100 rpm. The eccentricity ratio is 0.6. If the central lubrication system supplies lubricating oil of viscosity 46.7 cP at a flow rate of 0.5 liter per minute to the bearing, calculate:
 a. The diameter of journal b. The radial clearance
 c. The dimensions of bearing and, d. Minimum oil-film thickness
- Explain the following terms with respect to journal bearings
 a. Design variables c. Performance variables
 b. Sommerfeld number d. Eccentricity ratio
- Explain in detail the desirable properties of a lubricant. Classify lubricants and give examples.
- Define wear, briefly explain different types of wear.

3. Calculate the following when the DBT is 35°C, WBT is 23°C and the barometer reads 750 mm Hg:

- (i) Relative humidity
- (ii) Humidity ratio
- (iii) DPT
- (iv) Density
- (v) Enthalpy of atmospheric air.

4. Draw a labeled sketch and explain working of window air conditioning system?



ARKAJAIN
University
Jharkhand

6th Semester End Term Examination: 2021-22.

Subject : Refrigeration & Air Conditioning **Roll No:**
Course : B.TECH [ME]
Full Marks : 70 **Time : 3 Hours.**

Instructions to the Candidates:

- Read the question paper very carefully.
- Start writing from 2nd page onwards; Don't Write On The 1st Page Backside.
- Question Paper is divided into Three Parts -A, B & C.
- Part-A is containing 12 multiple choice questions.
- Part- B containing SIX questions out of which FOUR questions are to be answered.
- Part C containing FOUR questions out of which TWO questions are to be answered.
- Do not write anything except your Roll No. on the question paper.
- Possession of Mobile Phones or any kind of Written Material, Arguments with the Invigilator or Discussing with Co-Student will come under Unfair Means and will Result in the Cancellation of the Papers.

PART - A

Multiple Choice Questions

[12x1=12]

1. The ideal gas-refrigeration cycle is the same as the
 - a. Brayton cycle
 - b. Reversed Brayton cycle
 - c. Vapour compression refrigeration cycle
 - d. Vapour absorption refrigeration cycle
2. 'COP' of a reversible heat pump is 1.2. If it is reversed to run as reversible heat engine then its efficiency shall be
 - a. 0.833
 - b. 1.2
 - c. 0.2
 - d. 0.5
3. If a Carnot cycle has coefficient of performance 4, the ratio of maximum temperature to minimum temperature will be
 - a. 0.25
 - b. 5
 - c. 1.25
 - d. 3
4. Coefficient of performance (COP) of vapor compression refrigeration system

- cycle.
- Explain with a flow diagram, the working of aqua-ammonia vapour absorption refrigeration system.
 - Mention the chemical formula and the refrigerant number of following refrigerants:
 - Dichloride difluoro methane,
 - Propylene Ethylene
 - Dichloro tetrafluoro ethane,
 - Sulphur dioxide
 - List out the various psychrometry processes. Explain the process of heating and humidification.

PART-C

Answer any TWO out of FOUR

[2x15=30]

- A cold storage plant is required to store 20T of fish. The fish is supplied at a temperature of 30°C. The specific heat of fish above freezing point is 2.93 kJ/kg K. The specific heat of fish below freezing point is 7.26 kJ/kg K. The fish is stored in cold storage which is maintained at -8°C. The freezing point of fish is -4°C. The latent heat of fish is 235 kJ/kg. If the plant requires 75 kW to drive it, find:
 - The capacity of the plant, and
 - Time taken to achieve cooling. Assume actual C.O.P. of the plant as 0.3 of the Carnot C.O.P.
- A vapour compression refrigerator uses R-12 as refrigerant and the liquid evaporates in the evaporator at -15°C. The temperature of this refrigerant at the delivery from the compressor is 15°C when the vapour is condensed at 10°C. Find the coefficient of performance if the liquid is cooled by 5°C before expansion by throttling. Take specific heat at constant pressure for the superheated vapour as 0.64 kJ/kg K and that for liquid as 0.94 kJ/kg K. the other properties of refrigerant are as follows:

Temperature (°C)	Specific enthalpy		Specific entropy	
	liquid	vapour	liquid	vapour
-15	22.3	180.88	0.0904	0.7051
10	45.4	191.76	0.1750	0.6921

- increases with increase in T_c at constant T_e
- increases with decrease in T_e at constant T_c
- increases with increase in T_e at constant T_c
- does not change with variation of T_e at constant T_c
- The C.O.P. of a Carnot refrigerator in winter as compared to in summer will be:
 - Large
 - Unpredictable
 - Small
 - Same
- If the pressure range of compressor is low, then the COP will be
 - Low
 - Remains unchanged
 - High
 - Cannot be determined
- Effects of heat pump and refrigeration respectively are obtained at
 - Compressor and condenser
 - Condenser and evaporator
 - Evaporator and condenser
 - Compressor and evaporator
- The refrigeration system works on: -
 - Zeroth law of thermodynamics
 - Second law of thermodynamics
 - First law of thermodynamics
 - None of the above
- The throttling operation in a refrigeration cycle is carried out in
 - Evaporator
 - Discharge valve
 - Capillary tube
 - Expansion valve
- COP of air refrigerator is related with COP of vapor compression refrigerator as
 - $(COP)_{air} > (COP)_{vap.c}$
 - $(COP)_{air} = (COP)_{vap.c}$
 - $(COP)_{air} < (COP)_{vap.c}$
 - None of the above
- Sub cooling occurs when the vapour
 - Removes latent heat from the refrigerant
 - Removes sensible heat from the refrigerant
 - High latent heat
 - Low latent heat
- A refrigerant moving in a refrigerator follows:
 - Open system
 - Closed system
 - Both open and closed system exists
 - None of the above

PART - B

Answer any FOUR out of SIX

[4x7=28]

- Differentiate between heat engine, refrigerator and heat pump. What is meant by refrigeration? Define Unitofrefrigeration.
- Describe the open-air refrigeration systems with its T-s diagram
- Derive the expression for air refrigeration system working on reversed Carnot



ARKAJAIN
University
Jharkhand

6TH Semester End Term Examination: 2021-22.

Subject: Mechanical Vibration

Course: B.TECH ME

Full Marks: 70

Roll No:

Time : 3 Hours.

Instructions to the Candidates:

- Read the question paper very carefully.
- Start writing from 2nd page onwards; don't Write On The 1st Page Backside.
- Question Paper is divided into Three Parts -A, B & C.
- Part-A is containing 12 multiple choice questions.
- Part- B containing SIX questions out of which FOUR questions are to be answered.
- Part C containing FOUR questions out of which TWO questions are to be answered.
- Do not write anything except your Roll No. on the question paper.
- Possession of Mobile Phones or any kind of Written Material, Arguments with the Invigilator or Discussing with Co-Student will come under Unfair Means and will Result in the Cancellation of the Papers.

PART - A

Multiple Choice Questions

[12x1=12]

1. Motion of the particle is
(A) Simple Harmonic Motion (SHM) (B) No uniform
(C) Periodic (D) Straight line
2. The number of degrees of freedom in a continuous system is
(A) 0 (B) 1 (C) Between 2 to 3 (D) Infinite
3. Degree of freedom is
(A) Always more than 4
(B) The number of independent displacements
(C) The number of masses in the system
(D) Always one
4. The time period (T) of a particle executing SHM is
(A) π/ω (B) $2\pi/\omega$ (C) $3\pi/\omega$ (D) $\pi/2\omega$

- 5- The shock absorbers of automobiles are designed for
 (A) Critical damping (B) Under damping
 (C) Over damping (D) None of the above

- 6- Rayleigh's energy method can be applied to a system having
 (A) Constant potential energy at every point
 (B) Constant kinetic energy at every point
 (C) Conservative force
 (D) Non-conservative force

- 7- The amplitude of coulomb damping reduces
 (A) Periodically (B) Linearly
 (C) Exponentially (D) None of the above

- 8- The value of logarithmic decrement is
 (A) 0.42 (B) 1.22 (C) 2.32 (D) 3.12

- 9- Following vibrations are produced in the stretched wires of musical instruments
 (A) Forced transverse (B) Free transverse
 (C) Free longitudinal (D) None of the above

- 10- The following applies to forced vibrations
 (A) Forced vibrations are followed by free vibrations
 (B) Their amplitude decreases rapidly
 (C) No external force is required
 (D) None of the above

- 11- In Simple Harmonic Motion (SHM) the acceleration is directly proportional to
 (A) Frequency (B) Amplitude
 (C) Displacement (D) All of the above

- 12- The shape of graph between velocity and displacement, for a harmonic oscillator is
 (A) Parabolic (B) Linear (C) Elliptical (D) Hyperbolic

PART B

Answer any FOUR out of SIX

(4x7=28)

- a) What is meant by Vibrations?
 b) What Is The Difference Between Harmonic Motion And Periodic Motion?
- a) Define Free Vibrations?
 b) Explain Different Types Of Free Vibrations?
- a) What Is Rayleigh's Method, Write Its Applications?
 b) What Is The Critical Speed Of Shaft?
- a) What Are Three Elementary Part of A Vibrating System?
 b) What Is The Difference Between A Vibration Absorber And A Vibration Isolator?
- A) What Are The Causes Of Vibration?
 B) Give Two Examples Each of the Bad and Good Effects of Vibration?
- A machine of mass 100 kg is supported on openings of total stiffness 800 kN/m and has a rotating unbalanced element which results in a disturbing force of 400 N at a speed of 3000 r.p.m. assuming the damping ratio as 0.25, determine: 1. the amplitude of vibrations due to unbalance; and 2. the transmitted force.

PART C

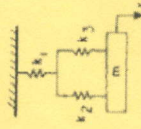
Answer any TWO out of FOUR:

(2x15=30)

- a) Add the following Harmonic motions Analytically and check the solution graphically
 $X_1 = 4 \cos(\omega t + 10)$
 $X_2 = 6 \sin(\omega t + 60)$
 b) The rectilinear motion of a point is given by $a = -9x$. Where α & x are the acceleration and displacement of simple harmonic motion and the amplitude of 2 inch

- a) A mass is suspended from a spring system as shown in figure. Determine the natural frequency of the system

$k_1 = 5000 \text{ N/m}$, $k_2 = k_3 = 8000 \text{ N/m}$, $m = 25 \text{ kg}$





ARKAJAIN
University
Jharkhand

6th Semester End Term Examination: 2021-22.

Subject : Fluid Machinery
Course : B.TECH [ME]
Full Marks : 70
Roll No:
Time : 3 Hours.

Instructions to the Candidates:

- Read the question paper very carefully.
- Start writing from 2nd page onwards; **Don't Write On The 1st Page Backside.**
- Question Paper is divided into Three Parts -A, B & C.
- Part-A is containing 12 multiple choice questions.
- Part- B containing SIX questions out of which FOUR questions are to be answered.
- Part C containing FOUR questions out of which TWO questions are to be answered.
- Do not write anything except your Roll No. on the question paper.
- Possession of **Mobile Phones** or any kind of **Written Material, Arguments with the Invigilator or Discussing with Co-Student** will come under **Unfair Means** and will **Result in the Cancellation of the Papers.**

PART - A

Multiple Choice Questions

[12x1=12]

1. The force analysis on a curved vane is understood using _____
 - a) Velocity triangles
 - b) Vane angles
 - c) Angle of the plate
 - d) Plate dimensions
2. Jet propulsion is a method of generating propulsive force by reaction of _____
 - a) Accelerating mass
 - b) Mass flow rate
 - c) Volume
 - d) Velocity
3. Which principle is used in Hydraulic Turbines?
 - a) Faraday law
 - b) Charles law
 - c) Newton's second law
 - d) Bragg's law
4. Impulse turbine and reaction turbine are classified based on?
 - a) Type of energy at inlet
 - b) Head at inlet of turbine
 - c) Direction of flow through runner
 - d) Specific speed of turbine

- In Pelton turbine the energy available at inlet of runner that is at outlet of nozzle is known as
 - Shaft power
 - Output power
 - Runner power
 - Water power
- Why does the cross sectional area of the Spiral casing gradually decreases along the circumference of the Francis turbine from the entrance to the tip?
 - To ensure constant velocity of water during runner entry
 - To prevent loss of efficiency of the turbine due to impulsive forces caused by extra area
 - To prevent leakage from the turbine
 - To reduce material costs in order to make the turbine more economical
- A draft tube helps in converting kinetic energy into _____
 - Electrical work
 - Chemical work
 - Mechanical work
 - Thermal work
- Which of the following efficiencies for Kaplan Turbine is described as the ratio between the power produced by runner to the power supplied by water at the inlet?
 - Hydraulic efficiency
 - Mechanical efficiency
 - Volumetric efficiency
 - Overall efficiency
- Specific speed of a Pelton wheel with single jet is _____
 - 8.5 to 30
 - 51 to 225
 - 30 to 51
 - 230 to 500
- Which among the following is not a unit quantity of turbine?
 - Unit speed
 - Unit power
 - Unit discharge
 - Unit temperature
- Power operated pump in which only one side engages the fluid displacement is called _____
 - Froth pump
 - Double acting
 - Single acting
 - Bicycle pump
- What is the function of the air compressor?
 - Decreases the pressure of air
 - Removes dust particles
 - Increases the pressure of air
 - Adds lubricating oil

PART - B

Answer any FOUR out of SIX

[4x7=28]

- Define and Classify Hydraulic machines, turbines and pumps.
- Derive the equation for force exerted by a jet of water on moving inclined plate in the direction of jet in terms of area of jet (a), inclination of plate with jet (θ), velocity of jet (V) and speed of plate (u).

- Define specific speed of a turbine. Derive an expression for Specific speed. How turbines are classified based on specific speed.
- A turbine is to operate under a head of 25 m at 240 rpm. The discharge is 9 cumec. If the efficiency is 85 %, determine the power, discharge and speed of the turbine under a head of 20 metres.
- Draw velocity triangle for a centrifugal pump and derive expression for work done on water by impeller and efficiency of the pump.
- Write difference between reciprocation and rotary air compressors.

PART-C

Answer any TWO out of FOUR

[2x15=30]

- Draw and explain the schematic diagram of Pelton wheel turbine. Also Draw velocity triangles at inlet and outlet of Pelton turbine.
 - A pelton wheel is having a mean bucket diameter of 0.8 m and is running at 1000 rpm. The net head on the pelton wheel is 400 m. If the side clearance angle is 15° and discharge through nozzle is 150 litres/sec, find
 - Power available at the nozzle and
 - Hydraulic efficiency.
- Show that, Draft tube develop negative pressure at the outlet of turbine with usual notation.
 - A turbine is to operate under a head of 25m at 200 rpm. The discharge is 9 cumec. If the efficiency is 90%, determine the Speed, power and discharge under a head of 20 m.
- Derive expression for Discharge and work done by a reciprocating pump with usual notations.
 - A single acting reciprocating pump, running at 50 rpm, delivers 0.01 m³/s of water. The diameter of the piston is 200 mm and stroke length is 350 mm. Determine (i) Theoretical discharge (ii) Slip and (iii) Power required if pump is operating against a total head of 25m.
- Derive expression for indicated power, isothermal efficiency and mechanical efficiency for reciprocating compressor.
 - A single stage reciprocating air compressor takes in 8m³/min of air at 1 bar and 300° C and delivers it at 6 bar. The clearance is 5% of the stroke. The expansion and compression are polytropic with the value of n=1.3. Calculate: (a) the temperature of delivered air; (b) volumetric efficiency, and (c) Power of the compressor.