JAGANNATH UNIVERSITY

QUESTION BANK
Sub:- Thermodynamics (302)

UNIT-1

Q1 Explain the state of equilibrium. Also discuss thermal, chemical and mechanical equilibrium with suitable examples.

Q2. Explain the different types of systems with neat sketches and suitable examples.

Q3. Explain Zeroth law of Thermodynamics

Q4. Define the temperature. Name the different temperature scales in common use and establish a relation between Celsius and Fahrenheit scale.

Q5. Write short notes on following:

1 Equality of temperature
2 Law of perfect gases
3 Process and cycle
4 Point Function, Path Function

Q6. A fluid at a pressure of 3 bar and with specific volume of 0.18 m^3/kg contained in a cylinder behind a piston expands reversibly to a pressure of 0.6 bar according to a law , $\mathbf{p=c/v^2}$ where **c** is a constant .Calculate the work done by the fluid on the piston.

Q7. What is pure substance? Draw the phase equilibrium diagram for a pure substance on T-S plot with relevant constant property lines.

Q8. Draw the phase equilibrium diagram for a pure substance on h-s plot with relevant constant Property lines.

Q9. Pressure of the steam inside a boiler, as measured by pressure gauge, is 2 N/mm^2. The barometric pressure of the atmosphere is 765 mm of mercury. Find the absolute pressure of steam in N/m^2, kPa, bar and N/mm^2.

Q10. What is energy? Explain the different types of energy in detail.

UNIT-2

Q1. A) Explain First law of thermodynamics.

B) Explain and derive Steady Flow Energy Equation.

Q2. What do you mean by the term ' Property'? Prove that Heat and Work is not a point function.

Q3. Derive the work done for following process:

1 Isochoric process
2 Isobaric process
3 Isothermal process
4 Adiabatic process
5 Polytrophic process

Q4. Derive amount of heat transfer for the above processes in previous question.

Q5. a) Explain Second Law of Thermodynamics. Prove that violation of Kelvin Plank statement leads to violation of Clausius statement.

b) Prove that the violation of Clausius statement leads to violation of Kelvin Plank statement.

Q6. A cyclic heat engine operates between a source temperature of 800 ^{0}C and A Sink temperature of 30^{0}C.What is the least rate of heat rejection per KW net output of the engine?

Q7. In a steady flow process, a substance flows at the rate of 300 kg/min. It enters at a pressure of 6 bar ,a velocity of 300 m/s internal energy2000kj/kg and specific volume 0.4 m^3 kj/kg. It leaves the system at a pressure of 0.1 MPa , a velocity of 150m/s, the internal energy1600 kj/kg and specific volume 1.2 m^3 . The inlet is 10 m above the outlet. During its passage through the system the substance has a work transfer of 3 MW to the surroundings. Determine the heat transfer in kj /s. Stating whether it is from or to the system.

Q8. Explain the difference between heat pump and refrigerator, also find the C.O.P.

Q9. A reversible heat engine operates between two reservoirs at temperature of 600^{o}C and 40^{o}C. The engine derives a reversible refrigerator which operates between reservoirs at temperature of 40^o C and -20^o C. The heat transfer to the engine is 2MJ and the net work output of the combined engine and refrigerator plant is 360kJ. Find the heat transfer to the refrigerant and the net heat transfer to the reservoir at 40^o C. Also find these values if the efficiencies of heat engine and C.O.P. of refrigerator are each 40% of the maximum possible values.

Q10. Define the term 'Entropy'. Derive an expression for change of entropy for following process.

1 Isochoric process
2 Isobaric process
3 Isothermal process
4 Adiabatic process

Q11. Write short notes on following associated with S.F.E.E.

(i) Nozzle (ii) Throttle Valve (iii) Turbine

UNIT-3

Q1 what do you understand by high grade energy and low grade energy? Deduce the expression or available energy from a finite energy source at temperature T When the environmental temperature is T.

Q2. Derive Maxwell's equation.

Q3. Give the Gibbs phase Rule for a non reactive system

Q4. Explain Joule Kelvin Effect. What is Inversion Temperature?

Q5. Derive the following expression

$TdS=Cp\,dT - T(\partial V/\partial T)p\,dp$

Q6. Derive an expression for clausius clapeyron equation.

Q7. Derive an expression for Joule Thomson coefficient.

Q8. A mass of 1.5kg and volume of 0.14m^3 of certain gas at 40 bar is expended isentropically such that temperature falls to 500 K. Determine

1. Initial temperature of gas
2. Work done during the process
3. Pressure at end of expansion.

Take R=0.287 kJ/kgK , and C_v=0.718 kJ/kgK

UNIT-4

Q1. With the help of p-v and T-s diagram, show that for the same maximum pressure and temperature of the cycle and the same heat rejection,

$$\eta_{Diesel} > \eta_{Dual} > \eta_{Otto}$$

Q2. Derive an expression for Efficiency in following cycles

1. Stirling Cycle
2. Air Standard Cycle
3. Bryaton Cycle

Q3. (a) Explain the working of four stroke and two stroke petrol engine with neat diagram.

(b) List out the differences between S.I. engine and C.I. engine.

Q4. Determine the efficiency of diesel engine

Q5. Derive an expression for pressure ratio, temperature ratio and efficiency for otto cycle.

Q6. Derive an expression for pressure ratio, temperature ratio and entropy difference for dual cycle.

Q7. In an air standard otto cycle, the compression ratio is 7 and the compression begins at 1 bar and 313K. the heat added is 2510 kJ/kg. Find the

(1). Maximum temp and pressure of the cycle

(2) Work done per kg of air

(3) Cycle efficiency and mean effective pressure.

Take for air C_v=0.718kJ/kgK and R=287 J/kgK

Q8. Derive an expression of efficiency of Atkinston cycle.

Q9 Two engines are to operate on otto and diesel cycle with the following data:

Maximum temperature=1500K; Exhaust temperature=700K; Ambient conditions= 1 bar and 300K

Compare the compression ratios and maximum pressures and efficiencies of two engines.

Q10. An air engine, working on stirling cycle, has lower limit of temperature of 400^{o}C. The maximum and minimum pressure limits are 12 bar and 2 bar. If the expansion ratio of the cycle is 3 then find the ideal efficiency.

Q11. (a) Derive an expression for efficiency of Ericsson cycle.

(b) An Ericsson regenerative engine works between the temperature limit of 25^{o}C and 230^{o}C. if the ratio of expansion is 2. Determine Work done per kg of air and efficiency of the cycle.

UNIT-5

Q1. Explain the Rankine cycle with neat diagram.

Q2. Explain the vapour compression refrigeration cycle with neat diagram.

Q3. Explain following:

(i) Avogadro's Law

(ii) Bleeding process

(iii) Enthalpy

Q4. Define Cp& Cv. Derive following expression:

Cp-Cv =R

Q5. A cyclic steam power plant is to be designed for a steam temperature at turbine inlet of 360^0C and an exhaust pressure of 0.08bar. After isentropic expansion of steam in the turbine, the moisture content at the turbine exhaust is not to exceed 15%. Determine the greatest allowable steam pressure at he turbine inlet, and calculate the Rankine efficiency.

Q6. One Kg steam at a pressure of 4 bar and a dryness fraction of 0.963 is compressed isentropically until it is dry saturated. Heat is then supplied at constant pressure until the initial volume is attained and the steam is finally restored to its initial state by constant volume cooling. Evaluate the work and heat transfer in each step and verify that the net work done is equal to the difference between the heat supplied and heat rejected over the cycle

Q7. In a regenerative cycle, having one feed water heater, the dry saturated steam is supplied from the boiler at a pressure of 30 bar and condenser pressure of 1 bar. The steam is bled at a pressure of 5 bar. Determine the amount of bled steam per kg of steam supplied and the efficiency of the cycle. What would be the efficiency without regenerative feed heating? Also determine the percentage increase in efficiency due to regeneration.

Q8. (a) Describe regenerative feed heating as use in thermal power plant and its advantages.

(b) What is reheat factor? Explain heat with the h-s diagram.

Q9. A steam power plant uses the following cycle:

Steam at boiler outlet—150 bar, 550^0C, reheat at 40bar to 550^0C, condenser at0.1 bar. Find the quality at turbine exhaust and cycle efficiency.

Q10. A refrigeration machine using R-12 as refrigerant operates between the pressures 2.5 bar and 9 bar. The compression is isentropic and there is no under cooling in the condenser.

The vapour is in dry saturated condition at the beginning of the compression. Estimate the theoretical coefficient of performance. If the actual coefficient of performance is 0.65 of theoretical value. Calculate the net cooling produced per hour. The refrigerant flow is 5 kg/min. Properties of refrigerant are

Pressure (bar)	**Saturation temperature, ^{o}C**	**Enthalpy, kJ/kg**		**Entropy of saturated vapour, kJ/kgK**
		Liquid	**Vapour**	
9.0	36	456.4	585.3	4.74
2.5	-7	412.4	570.3	4.76

Take C_p for superheated vapour at 9 bar as 0.67kJ/kgK.

JAGANNATH UNIVERSITY

QUESTION BANK
Sub:- Mechanics of Solids (ME 304)

UNIT 1

1 A rod 150 cm long and of diameter 2 cm is subjected to an axial pull off 10 KN. If the modulus of elasticity of the material of the rod is2 x10^5N/mm^2 . Determine

(i) Stress

(ii) Strain

(iii) Elongation force

2 A tensile test was conducted on a mild steel bar. The following data was obtained from the test.

(i) Diameter of the steel bar = 3 cm

(ii) Gauge length of the bar = 20 cm

(iii) Load at elastic limit = 250 kN

(iv) Extension at a load of 150 kN = 0.21 mm

(v) Minimum load = 380 kN

(vi) Total extension = 30 mm

(vii) Diameter of rod at the failure = 2.25 cm

Determine :

(a) The young's modulus (b) the stresses at elastic limit

(c) the percentage elongation, and (d) the percentage decrease in area

3 An axial pull of 30,000 N is acting on a rectangular bar . If the young modulus is 2x 10^5N/mm2 . Determine :

(i) Total extension of the bar

4 What is Hooke's law? Explain proof stress, yield strength and ultimate strength of the stress-strain curve for ductile material.

5 A brass bar, having cross - sectional area of 1000 mm^2 is subjected to axial forces. Find the total elongation of the bar. Take E=2x 10^5. N/mm^2

6 A reinforced concrete column is 300 mm x 300 mm in section. The column is provided with 8 bars of 20 mm diameter. The column carries a load of 360 kN. Find the stresses in concrete and the steel bars. Take E_s = 2.1 x 10^5 N/mm^2 and E_c = 0.14 x 10^5 N/mm^2.

7 The piston of a steam engine is of 200 mm diameter and the piston rod is of 30 mm diameter. The steam pressure is 1.2 N/mm^2. Find the stress in the piston rod and the elongation of a length of 750 mm, when the piston is on the in stroke. Take E = 2 x 10^5 N/mm^2.

8 A rigid beam AB 4.8 m long is hinged at A and supported by two steel wires CD and EF. CD is 12 m long and 24 mm in dia and EF is 6 m long and 6 mm in dia. If a load of 2250 N is applied at B, Determine the stress in each wire.Take 2x 10^5N/mm^2

9 A bar is subjected to a tensile load of 200 kN Find the diameter of the middle portion if the stress there is to be limited to 160 N/mm2 . Find also the length of the middle portion if the total elongation of the bar is to be 0.20 mm. Take E= 2x 10^5N/mm2 .

10 A steel rod 20 mm in diameter passes centrally through a steel tube 35 mm internal diameter and 40 mm external diameter. The 800 mm long tube is fastened by thread nuts. The nuts are until the compressive load on the tube is 30 kN. Calculate the stresses in the tube and the rod. Determine the increase in these stresses when nut is tightened by one quarter of a turn relative to the other. There are 6 threaded per 10mm, Take E 2x 10^5N/mm^2

UNIT 2

1. A point is subjected to a tensile stress of 60 N/mm^2 and a compressive stress of 40 N/mm^2, acting on two mutually perpendicular planes, and a shear stress of 10 N/mm^2 on these planes. Determine principal as well as maximum shear stresses. Also find out the value of maximum shear stress.

2. The principal tensile stresses at a point across two mutually perpendicular planes are 100 N/mm^{2}and 50 N/mm^2 . Determine the normal, tangential and resultant stresses on a plane inclined at 30_ to the axis of the minor principal stress.

3. In a strained material at a point the principal tensile stresses across two perpendicular planes are 120 N/mm^2 and 60 N/mm^2 . Determine normal stress, shear stress and the resultant stress on a plane inclined at 30_ with major principal plane. Determine also obliquity. What will be intensity of stress, which acting alone will produce the same maximum strain if Poisson's ratio=0.25

4. The principal stresses are 100 N/mm^2 tensile and 50 N/mm^2 compressive at a point in a strained material. Determine the resultant stress in magnitude and direction on a plane inclined at 60_ to the axis of the major principal stress.What is the maximum intensity of shear stress in the material?

5. A small block is 5 cm long, 4 cm high and 0.5 cm thick. It is subjected to uniformly distributed tensile forces of resultant 1000 kgf and 400 kgf .Determine the normal and shear stresses developed along the diagonal *EF*.

6. When body is subjected to two mutually perpendicular direction,the stresses are 100 N/mm^2 tensile and 50 N/mm^2 tensile .Each of the above stresses is accompanied by a shear stress of 60 N/mm^2 . Determine the normal stress and resultant stress on an oblique plane inclined at an angle of 45_ with the axis of minor tensile stress.

7. Compare crippling load given by Euler's and Rankine's formulae, for a hallow circular column of 2.5 m long, having outer and inner diameters as 45 mm and 35 mm respectively, loaded through hinge joints at the ends. Taking yield stress of column material as 310 N/mm^2 , the Rankine's Constant 1 7500 and *E* 2x 10^5_ N/mm^2. For what length of column of this sectional are does the Euler's formula cases to apply

8. A rolled steel joist is to be used as a column of 3.2 meters length with both ends fixed. Find the safe axial load on the column by Rankine formula. Assume factor of safety 3, _*c* _ 320 N/mm2 and *a* _7500and for column section, Area _ 5626 mm2 , *I xx* _ 8603 107 . mm4*I yy*_ 4539 107 . mm4

9. When material strained at a certain point, the stresses on two planes, at right angle to each other are 30 N/mm^2 and 15 N/mm^2 both tensile .They are accompanied by a shear stress of 15 N/mm^2 . Determine the location of principal planes and evaluate the principal stresses

10. The principal stresses at a point in a bar are 400 N/mm^2 tensile and 200 N/mm^{2}compressive. Determine the resultant stress and direction of plane at inclined at 60_ to the major principal stress by mohr's circle.

UNIT 3

1. A shaft section 100 mm in diameter is subjected to a bending moment of 6000 Nm and a torque of 8000 Nm. Find the maximum direct stress induced on the section and specify the position of the plane on which it acts. Find also what stress acting alone can produce the same maximum strain. Take poisson's ratio=1/4.

2. A flywheel weighing 8000 N is mounted on a shaft 100 mm in diameter and midway between bearing 800 mm apart in which the shaft may be assumed to be directionally free. If shaft is transmitting 40 kW at 400 rpm. Calculate the principal stresses and the maximum shearing stresses in the shaft at the ends of a vertical and horizontal diameter in a plane close to the flywheel.

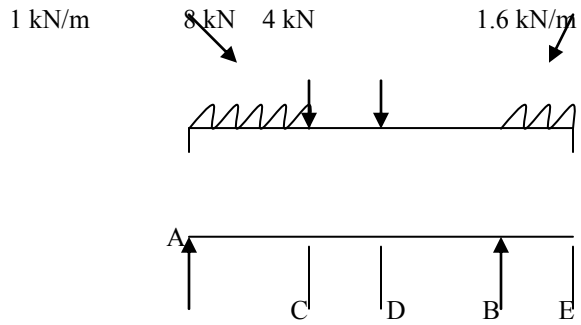
3. A rectangular timber beam 5 m long has to carry a uniformly distributed load of 12 kN/m and a concentrated load of 9 kN at the mid of span. If the allowable bending stress is 8 N/mm^2 , find the section taking depth as twice the width.

4. A beam AB of 40 m span loaded as shown in fig 2.29 The beam is supported at*C* and *D* points having 8 m overhang of the left of support C and an overhang of *R* meter to the right of support *D*. Determine the value of *R* if the mind point of the beam is the point of inflexion and plot S.F.D and B.M.D.

5. A horizontal beam 10 m long carries a uniformly distributed load of 180 N/m and in addition a concentrated load of 200 N at the left end. The beam is supported at two points 7 m apart, so chosen that each support carries half the total load. Draw S.F. and B.M. diagram for the beam.

6. A Lintel of 4 meter span supports a brick wall of 15 cm thick. The light of the wall is 1 meter at one end and increase uniformly to 4 meter at other end. Calculate the maximum bending moment on the beam if the bricks weighs 23 kN/m3 . Draw S.F.D and B.M.D.

7. Draw the shear force and the bending moment diagrams for the beam shown below:



8. A rectangular simple supported beam 80 mm wide and 160 mm deep is used over a span if 4 m with a distributed load of 1.5 kN/m. Find out (i) The maximum stress developed at a section 1m from the right load support (ii) The position and magnitude of the maximum stress developed in the material of the whole
span of the beam.

9. A timber beam of rectangular section is to support a load of 18 kN uniformly distributed over a span of 3.6 meters. If the sections to be twice the breadth and the stress in timber is not exceed 40 N/mm2 , find the cross section. How can we modify the cross section of the beam, if it were a concentrated load placed at the centre with the same ratio of breath to depth.

10. Explain all types of supports and loads. what do you understand by point of contraflexture

UNIT 4

1. Find the torque which a shaft of 110 mm diameter can transmit safely, if the permissible value of shear stress of shaft material is 100 N/mm^2 .

2. A hollow circular shaft of external diameter 60 mm and wall thickness 6 mm transmit a torque of 10 kNm. Determine the maximum shear stress induced in the shaft.

3. A solid shaft subjected to a torque of 90 Nm. Find the necessary shaft diameter if the allowable shear stress is 105 N/mm2 and the allowable twist is 3 degree per 10 diameter length of the shaft. Assume G 2x 10^5_ N/mm^2

4. Two shafts of same material and same length are subjected to same torque. One of them is solid circular shaft and second one is hollow circular shaft having internal diameter is 3/4 th of the external diameter and maximum shear stress induced in each of them are same. Compare the weight of of the two shafts.

5. A hollow steel shaft having internal diameter half of the external diameter transmit 150 kW at 230 rpm. If the maximum allowable shear stress is not to exceed 8 kN/cm^2 and the angle of twist is mot exceed 1_ in length of 20 times the external diameter, select suitable dimensions of shaft. Assume G 1x 10^4_ kN/cm^2

6. A solid shaft is transmitting 760 kW at 80 rpm. If the maximum permissible stress of shaft material is 50 N/mm^2, Calculate the diameter of shaft. If this shaft is replaced by a hollow shaft having inner diameter is 0.6 of outer diameter, what will be the percentage saving of material. The torque, maximum shear stress, the material and shafts length are same in either cases

7. Prove that for same material, same length and same weight, a hollow shaft is always be stronger than a solid shaft, when subjected or simple torque

8. A solid shaft of diameter 5 cm rotates at 530 rpm. It is supported in bearings so placed that the bending of shaft will be negligible. Pulley *A* receive 38 kW and pullies *B* and*C* delivers 22 kW and 16 kW to another shafts respectively. Assume G _ 8x 10^4_ N/cm^2 . Find:

(A) Shear stress in the length *AB* and *BC*

(B) The angle of twist of the end *A* with respect to *C*

9. A shaft ABC of length 1 m has two parts AB and BC. The part AB has 60 mm external and 48 mm internal diameter. The part *BC* has 60 mm external and 36 mm internal diameter. If the shear stress in the shaft is not exceed 100 N/mm^2 , find the maximum power that can be transmitted at a speed of 150 r.p.m. If the angle of twist of both part *AB* and *BC* are equal, find the length of each part.

10. Derive a relation for torque of a shaft in terms of its length, angle of twist, and modulus of rigidity.

UNIT 5

1. The load on a bolt consists of an axial pull of 20 kN together with a transverse shear of 10 kN. Determine the diameter of the bolt according to (i) maximum principal stress theory (ii) maximum shear stress theory (iii) maximum strain theory (iv) strain energy theory (v) shear strain energy theory. Elastics limit in tension is 300 N/mm2 and a factor of safety 2 Take $\mu = 0.25$.

2. A body is under the action of two principal stress of 60 N/mm^2 and -80 N/mm^2 . If the elastic limit in simple tension as well as compression is 200 N/mm^2 . Find the factor of safety according to the five theories. Take $\mu = 0.25$.

3. A 60 kN tensile load is gradually applied to a circular bar of

40 mm diameter and 5 m long. Determine

(i) Stretch in the rod

(ii) Stress in the rod

(iii) Strain energy absorbed by the rod. (E _ 200GN/m^2)

4. Evaluate instantaneous stress produced in a bar 1000 mm2 in area and 3m long by the sudden application of a tensile load of unknown magnitude, If the extension of the bar due to suddenly applied load is 1.5 mm. Also determine the suddenly applied load. Take E _ 200 GN/m^2

5. A 5 m long bar is made up of two parts, 3 meter of its length has a cross-sectional area of 1000 mm2 while the remaining 2 meter has a cross sectional area of 2000 mm2 . An axial load of 80 kN is gradually applied. Find the total strain energy produced in the bar and compare this value with that obtained in a uniform bar of the same length and having the same volume when under the same load. (E _ 200GN/m^2).

6. A 10 kN weight falls by 30 mm on a collar rigidly attached to a vertical bar 4 m long and 1000 mm2 in section. Find the instantaneous expansion of the bar, (E _ 21_105 . N/mm^2).

7. The shear stress is produced in a material at a point is 50 N/mm^2 . Find the load strain energy per unit volume stored in the material due to shear stress Take C _ 80 GN/m^2

8. Find out slope and deflection of a cantilever with uniformly distributed load on its whole length beam by double integration method.

9. Find out slope and deflection of a simply supported beam with uniform distributed load on the whole beam by area moment method.

10. Explain and derive castiglianos theorem.

JAGANNATH UNIVERSITY

Question Bank

Subject: Materials Science and Engineering (ME306)

Unit 1

1. Describe the difference in atomic/molecularstructure between crystalline and noncrystalline materials.

2. Draw unit cells for face-centered cubic, bodycentered cubic, and hexagonal close-packed crystal structures.

3. Derive the relationships between unit cell edge length and atomic radius for face-centered cubic and body-centered cubic crystal structures.

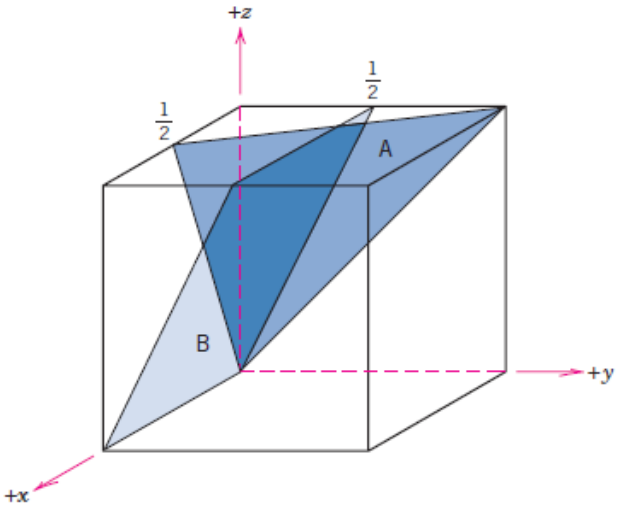
4. Distinguish between single crystals and polycrystalline materials.

5. Define isotropy and anisotropy with respect to material properties.

6. Within a cubic unit cell, sketch the following directions:

- (1 0 1̄)
- (1̄ 1 1)
- (0 2 0)
- (1 0 1)
- (1 1̄ 1̄)

7. Determine the Miller indices for the planes shown in the given diagram of unit cell:



8. Write short notes on Polymorphism and Allotropy.

9. Explain the following:

- APF
- Co-ordination No.
- Effective no of atoms
- Burger Vector
- CRSS

10. Explain the following crystal Imperfections:

- Vacancies
- Impurities
- Frankel Defect
- Edge Dislocation
- Surface Defects

Unit 2

1. Describe how plastic deformation occurs by the motion of edge and screw dislocations in response to applied shear stresses.

2. Describe how plastic deformation occurs by the motion of edge and screw dislocations in response to applied shear stresses.

3. Define slip system and cite one example.

4. Describe how the grain structure of a polycrystalline metal is altered when it is plastically deformed.

5. Explain how grain boundaries impede dislocation motion and why a metal having small grains is stronger than one having large grains.

6. What is preferred orientation? Explain its effects on the properties of a material.

7. Describe and explain the phenomenon of strain hardening (or cold working) in terms of dislocations and strain field interactions.

8. Describe recrystallization in terms of both the alteration of microstructure and mechanical characteristics of the material.

9. Describe the phenomenon of grain growth from both macroscopic and atomic perspectives.

10. Explain Twinning in detail with reference to deformation of materials. Draw proper figure and give one example.

Unit 3

1. Cite the general mechanical characteristics for each of the following microconstituents: Pearlite, Spheroidite, Bainite, Martensite.

2. Draw and Explain Equilibrium diagram of binary system having complete mutual solubility in liquid state and partial solubility in solid state.

3. Explain the following:

- Gibbs Phase Rule
- Hume Rothery's Rules

4. Explain Nuclear Formation and Crystal Growth.

5. Draw the Iron Carbon equilibrium diagram with detailed explanation of various phase transformations.

6. Explain the austenite phase of Fe-C diagram, its properties nad various possible transformations.

7. Write the various differences in Pearlite and Ferrite.

8. How is austenite transformed into martensite? Explain properties of Martensite and its crystal structure.

9. Draw the TTT Curve of tseel and explain it in detail. What are S-Curves?

10. Write short notes on:

- Eutectic reactions
- Peritectic reactions
- Eutectoid reactions

Unit 4

1. Explain Annealing, its principle and applications with example.

2. What is meant by Normalizing? How is it done? What are its effects on the properties of Steel?

3. Write short notes on:

- Hardening
- Quenching
- Tempering

4. Explain Recovery, Re-crystallization and Grain Growth with proper figure.

5. What is Hardenability? Explain the variables affecting it and any one method to determine hardenability.

6. What do you mean by Overheated or Burnt Steel? What are its causes and remedies?

7. Write down the various principles involved in heat treatment of plain carbon steels and alloy steels.

8. What is chemical heat treatment of steel? Write down its advantages and disadvantages over traditional methods of heat treatment.

9. Explain Carburizing with details of various methods of carburizing (pack, liquid and gas carburizing)

10. Write short notes on:

- Nitriding
- Cyaniding
- Carbo-nitriding

Unit 5

1. What is an Alloy? Why are alloying elements added to steel? How does alloying change the crystal structure of steel?

2. Explain the effects of adding the following alloying materials to steel:

- Si
- Mn
- Cr
- Co
- W
- Ti

3. What are various structural classes of steels and their properties.

4. What are the various ways to classify steels?

5. What is meant by BIS? Write down the various BIS standards for Steels.

6. Explain the various fibre reinforced plastic composites, their properties and applications.

7. Explain any two basic composite manufacturing methods with proper figures.

8. Write short notes on:

- Polymer-Matrix Composites
- Metal-Matrix Composites
- Ceramic-Matrix Composites
- Carbon-Carbon Composites

9. Write down the various applications of composite materials (min. 7).

10. Cite the difference in strengthening mechanism for large-particle and dispersion-strengthened particle-reinforced composites.

Jagannath University, Jaipur

Question Bank

Subject: Fluid Mechanics and Hydraulics (ME401)

Unit- I

Q1. Define the following fluid properties: Density, Weight Density, Specific Volume and Specific Gravity

Q2. What do you mean by Dynamic Viscosity and Kinematic Viscosity? Explain with their Dimensions.

Q3. Explain the Newton's Law of Viscosity in detail? What are Newtonian and non-Newtonian fluids? Also draw the Rheological diagram for various types of fluids.

Q4. Define Surface tension and derive the relationship between surface tension and pressure inside a droplet of diameter "d".

Q5. Explain the variation of viscosity with temperature in case of liquids and gases.

Q6. Two plates are placed at a distance of 0.15mm apart. The lower plate is fixed while the upper plate having surface area 1.0 m2 is pulled at 0.3 nm/s. Find the force and power required to maintain this speed, if the fluid separating them is having viscosity 1.5 poise.

Q7. A plate, 0.025 mm distant from a fixed plate, moves at 50 cm/s and requires a force of 1.471 N/ m2 to maintain this speed. Determine the fluid viscosity between plates in the poise.

Q8. Determine the intensity of shear of an oil having viscosity =1.2 poise and is used for lubrication in the clearance between a 10 cm diameter shaft and its journal bearing. The clearance is 1.0 mm and Shaft rotates at 200 r.p.m.

Q9. Calculate the capillary rise in glass tube of 3mm diameter when immersed in mercury; take the surface tension and angle of contact of mercury as 0.52 N/m and 1300 respectively. Also determine the minimum size of the glass tube, if it is immersed in water, given that the surface tension of water is 0.0725 N/m and Capillary rise in tube is not exceed 0.5 mm.

Q10. Find the surface tension in a soap bubble of 30 mm diameter when the inside pressure is 1.962 N/m^2 above atmosphere.

Unit-2

Q1. State and prove the Pascal's Law with figure.

Q2. What do you understand by Hydrostatic law? Derive the expression of pressure variation in a fluid at rest.

Q3. Explain U-Tube manometer and Inverted U-Tube manometer with neat sketches.

Q4. Derive the expression for the force exerted by a static fluid on a submerged vertical plate and locate the position of center of pressure.

Q5. Explain the following terms: Buoyancy, center of buoyancy, meta-centre, meta-centric height, gauge pressure and absolute pressure.

Q6. A U-tube differential manometer is connected two pressure pipes A and B. Pipe A contains Carbon tetrachloride having a specific gravity 1.594 under a pressure of 11.772 N/ Cm2 and pipe B contain oil of specific gravity 0.8 under pressure 11.72 N/ Cm2 . The pipe A lies 2.5 m above pipe B. Find the difference of pressure measured by mercury as a fluid filling U-tube.

Q7. A wooden block of width 2 m, depth 1.5 m and length 4 m floats horizontally in water. Find the volume of water displaced and position of centre of buoyancy. Specific gravity of wood block is 0.7.

Q8. A metallic body floats at the interface of mercury (Sp. Gr. 13.6) and water in such a way that 30% of its volume is submerged in mercury and 70% in water. Find the density of the metallic body.

Q9. Determine the total pressure and centre of pressure on an isosceles triangular plate of base 5 m and altitude 5 m when the plate is immersed vertically in an oil of sp. Gr. 0.8, the base of the plate is 1 meter below the free surface of water.

Q10. A hydraulic press has a ram of 30 cm diameter and a plunger of 5 cm diameter. Find the weight lifted by the hydraulic press when the force applied at the plunger is 400 N.

Unit 3

Q1. Explain the terms:

- Path Line
- Stream Line
- Streak Line
- Stream Tube

Q2. Explain the following with one practical example of each:

- Laminar Flow
- Turbulent Flow
- Steady Flow
- Uniform Flow
- Rotational Flow
- Compressible Flow

Q3. Define the continuity equation stating the underlying principle. Derive an expression for continuity equation in a 3-D flow.

Q4. Define the following:

- Total Acceleration
- Convective Acceleration
- Local Acceleration
- Velocity Potential Function
- Stream Function

Q5. Write Short Notes on:

- Free Vortex Flow
- Forced Vortex Flow
- Equipotential line
- Conditions for flow to be Irrotational

Q6. A 30 cm diameter pipe carries oil of specific gravity 0.8 at a velocity of 2 m/s. at another section in the same pipe the diameter is 20 cm. Find the velocity at this section and also mass rate of flow of oil.

Q7. Find out the missing velocity component in the following cases:

- $u=4x^2 + 3xy;\ w= z^3 - 4xy - 2yz;\ v=?$
- $u= 2x^2 + 2xy;\ w= z^3 - 4xz + 2yz;\ v=?$

Q8. A fluid flow is given by: $V=xy^2i - 2yz^2j - [zy^2 - (2z^3/3)]k$; Prove that it is a case of possible steady incompressible fluid flow. Also calculate the velocity and acceleration at the point *(1,2,3)*.

Q9. The velocity potential function $\varphi = x^2-y^2$. Find the velocity components in x and y directions. also show that 'φ' represents a possible case of fluid flow.

Q10. The stream function $\psi= 2x - 5y$. Calculate the velocity components and also the magnitude and direction of the resultant velocity at any point.

Unit-4

Q1. Derive Euler's equation for fluid flow. Obtain Bernoulli's equation from Euler's equation stating the assumptions made.

Q2. What is a Venturimeter? Derive an expression for discharge through a venturimeter. Discuss its merits and demerits with respect to an orificemeter.

Q3. What is a Pitot Tube? How can we determine the velocity at any point in a fluid flow with the help of Pitot tube? What is Pitot static tube?

Q4. State the following with examples where they are used:

- Momentum Equation
- Impulse Momentum Equation

Q5. Define:

- Orifice
- Mouthpiece
- C_v
- C_d
- C_c

Q6. The head of water over the centre of an orifice of diameter 30 mm is 1.5 m. The actual discharge through the orifice is 2.35 litres/sec; Find C_d.

Q7. The water is flowing in a taper pipe of length 50 m having diameters 40 mm and 20 mm at the upper and lower ends respectively. The pipe has a slope of 1 in 40 and the rate of flow is 60*litres/sec*. find the pressure at the lower end if the pressure at the higher end is 24.525 N/cm^2.

Q8. A 30 cm x 15 cm venturimeter is inserted in a vertical pipe carrying oil of specific gravity 0.8, flowing in upward direction. A differential mercury manometer connected to its inlet and throat gives a reading of 30 cm. find the discharge taking C_d=0.98.

Q9. Find the velocity of flow of oil through a pipe, when the difference of mercury level in a differential manometer connected to the two tappings of the pitot tube is 15 cm. Take coefficient of pitot tube = 0.98 and sp. gr. of oil as 0.8.

Q10. 250*litres/sec* of water is flowing in a pipe of diameter 300 mm. if the pipe is bent by 135˚ (initial to final direction), find the magnitude and direction of the resultant force on the bend. the pressure of water flowing is 39.24 N/cm^2.

Unit-5

Q1. What do you understand by the following terms :

- Major and Minor energy losses in pipes
- Hydraulic gradient line
- Pipes in parallel
- Equivalent pipe

Q2. Find an expression for power transmission through pipes. What is the condition for maximum power transmission and corresponding efficiency of power transmission?

Q3. Prove that the head loss due to friction is equal to one third of the total head at inlet for maximum power transmission through pipes.

Q4. A main pipe divides into two parallel pipes, which again forms one pipe. The length and diameter for the first parallel pipe are 2000 m and 1 m respectively, while the length and diameter of second parallel pipe are 2000 m and 0.8 m respectively. Find the rate of flow in each parallel pipe, if total flow in the main is $3m^3/s$. The coefficient of friction for each parallel pipe is same and equal to 0.005.

Q5. A pipe line carrying oil of specific gravity 0.85, changes in diameter from 350 mm at position 1 to 550 mm diameter to a position 2, which is at 6 m at a higher level. If the pressure at position 1 and 2 are taken as 20 N/cm^2 and 15 N/cm^2 respectively and discharge through the pipe is $0.2m^3/s$, determine the loss of head.

Q6. The rate of flow of water through a horizontal pipe is 0.3 m^3/s. The diameter of the pipe is suddenly enlarged from 25 cm to 50 cm. The pressure intensity in the smaller pipe is $14N/m^2$. Determine (i) Loss of head due to sudden enlargement, (ii)Pressure intensity in the large pipe and iii)Power lost due to enlargement.

Q7. Water is flowing through a tapering pipe of length 200 m having diameters 500 mm at the upper end and 250 mm at the lower end, the pipe has a slope of 1 in 40. The rate of flow through the pipe is 250 lit/sec. the pressure at the lower end and the upper end are 20 N/cm^2 and 10 N/cm^2 respectively. Find the loss of head and direction of flow.

Q8. Determine the length of an equivalent pipe of diameter 20 cm and friction factor 0.02 for a given pipe system discharging $0.1m^3/s$. The pipe system consists of the following:

(i) A 10 m line of 20 cm dia with f=0.03

(ii) Three 90˚ bend, k=0.5 for each

(iii) Two sudden expansion of diameter 20 cm to 30 cm.

Q9. A pipeline of length 2100 m is used for transmitting 103 kW. The pressure at the inlet of pipe is 392.4 N/cm2. If the efficiency of transmission is 80%, find the diameter of pipe. Take f=0.005.

Q10. A pipe of diameter 25 cm and length 2000 m connects two reservoirs having a 25 m difference in water levels. Determine the discharge through the pipe. If an additional pipe of diameter 25 cm ans length 1000 m is attached to the last 1000 m length of the existing pipe, find the increase in discharge. Take f= 0.015 and neglect minor losses.

JAGANNATH UNIVERSITY

QUESTION BANK

SUBJECT-Automobile Engineering (ME-402)

UNIT 1

Q1. What do you understand by chassis? List the various components of the Chassis by sketching a layout of the same.

Q2. What are the types of frames? What are the merits and demerits of the frameless construction over frame type Construction of the vehicle.

Q3. What are the functions and requirements of a clutch? Explain the construction and working of a centrifugal clutch.

Q4. What are the types of clutch operations? Explain the Hydraulic operation of a single plate clutch.

Q5. What are the functions of the Manual Transmission? Explain the construction and working of the Synchromesh

Gear Box.

Q6.What are needs of the Automatic Transmission? Explain the construction and working of the Torque Converter?

Q7 What are three active members of the planetary gear set? Write down their functions.

Q8.What is the difference between constant-mesh and synchromesh transmission? Describe any one of them.

Q9.What is the purpose of a steering system? State the requirements of good steering system.

Q10 Describe factors which pertain to steering geometry.

UNIT 2

Q11.How the 'King pin inclination' produce directional stability.

Q12.Define and explain the following:

a. Camber angle
b. Caster angle
c. Toe-in
d. Toe-out

Q13 "Battery is the heart of the electrical system in the automobile" Explain.

Q14.Explain the different type of battery. What do you understand by recharging of the battery?

Q15.Explain the following tests conducted to ascertain the conditions of battery:

a. Specific gravity test
b. Open volt test
c. High rate discharge test
d. Cadmium test

Q16.Enumerate the factors which affect battery life.

Q17. Discuss the construction and working of the starting motor for automobiles

Q18.What is different type of starting motor drives in current practices?

Q19. Explain briefly the Bendix drive and Over running drive..

Q20. Why the generator is required in the electrical system of a car?

UNIT 3

Q21.Explain the working principle and construction of an alternator.

Q22. What is the type of generators used in modern cars?

Q23.What do you mean by term 'Ignition'? How is it related with "combustion'?

Q24.What are the requirements of the ignition system for an I.C. Engines?

Q25.Describe with the help of a neat sketch explain a battery ignition system.

Q26. Name the various components of a battery ignition system and explain any three of them briefly.

Q27.What are difference between battery and magneto ignition system?

Q28.State the advantage and disadvantage of the battery ignition system.

Q29. What do you mean by term 'Ignition'? How is it related with "combustion'?

Q30.Draw a simplified wiring circuit for the lighting system of a car and discuss the same.

UNIT 4

Q31.Draw a layout of the air-conditioning system for a car and explain its working.

Q32.State the advantage and disadvantage of light alloy casting wheels.

Q33.What are functions of a tire?

Q34.Explain the components of leaf spring suspension system?

Q35.Describe briefly the following three basic suspension movements of a car:

a. Bouncing
b. Rolling
c. Pitching

Q36.Explain the working of centrifugal clutch with a suitable clutch..

Q38.What is the difference between ‘fluid coupling’ and ‘Hydraulic torque converter’?

Q39.What purposes are served by a gear box in the transmission system of an automobile?.

Q40.With the help of neat sketch explain the construction and working of multi plate clutch??

UNIT 5

Q41.Explain the working of automobile air-conditioning.

Q42.What is the purpose of the receiver-drier in automobile air-conditioning?

Q43.What purposes are served by a gear box in the transmission system of an automobile?.

Q44.How you perform the gravity test for automobile battery?

Q45.What is the function of a starting motor in automobile and explain the working principle of the same?

Q46. What is working of Bendix drive ,explain with neat sketch.

Q47.What is the purpose of the alternator in automobile and explain the construction and working of the same?

Q48.What you mean by battery rating and how you measure it in automobile batteries?.

Q49.Explain the battery charging methods in automobile battery?

Q50.What is the steering knuckle and pitman arm and explain the purpose of these with neat sketch?

JAGANNATH UNIVERSITY,JAIPUR

Questions Bank

Kinematics of machines (ME 403)

UNIT 1

Q1. What do you understand by dynamics of machine ,kinematics of machine and kinetics.

Q2. Give the definition of elements and pair. Classify both of them with suitable examples.

Q3. What do you understand by mechanism and also explain inversion of mechanism.

Q4. Define kinematic pairs , explain types of kinematic pairs and also explain types of constrained motion.

Q5. Explain inversion of mechanism . explain four bar chain and its inversion with diagrams.

Q6. Explain inversion of single slider crank chain and double slider crank chain.

Q7. In a pin jointed four bar mechanism ABCD. AB=300 mm, BC=CD=360 mm, and AD=600 mm. The angle BAD=60^0. The crank AB rotates uniformly at 100 rpm. Locate all the instantaneous centres and find the angular velocity of BC.

Q8. In a four bar chain ABCD , AD is fixed and is 150 mm long. The crank AB is 40 mm long and rotates at 120 rpm clockwise, while the link CD=80 mm oscillates about D. BC and AD are of equal length. Find the angular velocity of the link CD when angle BAD=60^0.

Q9. The crank of a slider crank mechanism rotates clockwise at a constant speed of 300 rpm. The crank is 150 mm and the connecting rod is 600 mm long. Determine : 1. Linear velocity and acceleration of the mid point of the

connecting rod, and 2. Angular velocity and angular acceleration of the connecting rod, at a crank angle of 45^0 from the inner dead centre position.

Q10. Explain coriolis component.

UNIT -2

Q1. Explain Davis and Ackerman steering mechanism with diagrams.

Q2. Explain trifler suspension with diagram.

Q3. Drive a relation for slip of the belt.

Q4. Explain relation for length of open belt and crossed belt.

Q5. Find a relation for power transmitted by a belt.

Q6.Drive length of the open belt drive in terms of diameters of the pulleys and distance between centre's of the pulley.

Q7. In a flat belt drive the initial tension is 2000 N. The coefficient of friction between the belt and the pulley is 0.3 and the angle of lap on the smaller pulley is 150^0. The smaller pulley has a radius of 200 mm and rotates at 500 r.p.m. Find the power in KW transmitted by the belt.

Q8. Derive a relation for ratio of driving tensions for flat belt and V belt drive.

Q9. Find the power transmitted by a belt running over a pulley of 600 mm diameter at 200 rpm. The coefficient of friction between belt and the pulley is .25, angle of lap is 160^0 and the maximum tension in the belt is 2500 N.

Q10. Drive a condition for the transmission of maximum power.

UNIT -3

Q1.Drive a relation for minimum frictional torque for flat pivotal bearing in case of

a) Uniform pressure

b) Uniform wear?

Q2. Explain friction and also give classification of friction.

Q3. Find out minimum effort required to move a body up on a rough inclined plane.

Q4. An effort of 1500 N is required to just move a certain body up an inclined plane of angle 12^0, force acting parallel to the plane. If the angle of inclination is increased to 15^0, then the effort required is 1720 N. find the weight of the body and the coefficient of friction.

Q5. Draw a labeled diagram of screw jack and also find out an expression for torque required to lift the load by a screw jack.

Q6.Drive a relation for minimum frictional torque for conical clutch in case of

a) Uniform pressure

b) Uniform wear?

Q7. What do you understand by a clutch and explain various types of clutches.

Q8. Determine the maximum, minimum and average pressure in plate clutch when the axial force is 4 KN. The inside radius of the contact surface is 50 mm and the outside radius is 100 mm. assume uniform wear.

Q9. An engine developing 45 KW at 100 rpm is fitted with a cone clutch built inside the flywheel. The cone has a face angle of 12.5^0 and a maximum mean diameter of 500 mm. the coefficient of friction is 0.2 . the normal pressure on the clutch face is not to exceed 0.1 N/mm^2.

Determine : 1. The axial spring force necessary to engage the clutch,

2. the face width required.

Q10. What do you understand by centrifugal clutch, explain with diagram and find out an expression for torque transmitted by centrifugal clutch.

UNIT -4

Q1. what do you understand by brake and Explain all types of brakes.

Q2. Derive a relation for braking torque for a differential band brake.

Q3. Derive a relation for braking torque required for a single shoe brake in all the three cases.

Q4. Find an expression for braking torque for a simple band brake

Q5. A band brake acts on the $3/4^{th}$ of circumference of a drum of 450 mm diameter which is keyed to the shaft. The band brake provides a braking torque of 225 N-m. one end of the band is attached to a fulcrum pin of the lever and the other end to a pin 100 mm from the fulcrum. If the operating force is applied at 500 mm from the fulcrum and the coefficient of friction is 0.25, find the operating force when the drum rotates in 1) anticlockwise direction 2) clockwise direction.

Q6. Find an expression for braking torque required for band and block brake .

Q7. A car moving on level road at a speed of 50 km/hr has a wheel base of 2.8 meters, distance of C.G from ground level 600 mm, and the distance of C.G from rear wheel 1.2 meters. Find the distance travelled by the car before coming to rest when brakes are applied,

1) To the rear wheels
2) To the front wheels
3) To all the four wheels
4) The coefficient of friction is 0.6.

Q8. Explain dynamometer, how it is different from the brake and give classifications of the dynamometer.

Q9. Find out an expression for brake power by prony brake dynamometer.

Q10. Find out an expression for power transmitted by an epicyclic train dynamometer

UNIT 5

Q1. What do you understand by cam, give its function and also type of motion it provides.

Q2. Give the classification of cams with neat diagrams and explain their motions

Q3. Draw a cam and follower arrangement. classify followers with their applications.

Q4. Draw displacement, velocity and acceleration diagram for a motion with uniform velocity.

Q5. A cam is to give the following motion to a knife edge follower:

1. Outstroke during 120^0 of the cam rotation; 2. Dwell for the next 30^0 of cam rotation; 3.Return stroke during next 60^0 of cam rotation, and 4.Dwell for the remaining 150^0 of the cam rotation.

The stroke of the follower is 50 mm and the minimum radius of the cam is 50 mm. The follower moves with uniform acceleration and uniform retardation during both the outstroke and return strokes. Draw the profile of the cam when the axis of the follower passes through the axis of the cam shaft.

Q6. Draw displacement, velocity and acceleration diagram for a motion with uniform acceleration and uniform retardation.

Q7.A cam is to give the following motion to a knife edge follower:

1. Outstroke during 60^0 of the cam rotation; 2. Dwell for the next 30^0 cam rotation; 3.Return stroke during next 60^0 of cam rotation, and 4.Dwell for the remaining 210^0 of the cam rotation.

The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm.The follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the cam when the axis of the follower passes through the axis of the cam shaft.

Q8. Draw displacement, velocity and acceleration diagram for a motion with cycloidal motion.

Q9. A cam is to give the following motion to a knife edge follower:

1. Outstroke during 90^0 of the cam rotation; 2. Dwell for the next 30^0 of cam rotation; 3.Return stroke during next 60^0 of cam rotation, and 4.Dwell for the remaining 180^0 of the cam rotation.

The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. The follower moves with simple harmonic motion during both the outstroke and return strokes. Draw the profile of the cam when the axis of the follower passes through the axis of the cam shaft.

Q10. Draw displacement, velocity and acceleration diagram for a motion with simple harmonic motion.

JAGANNATH UNIVERSITY

Question Bank
Manufacturing Process (ME 405)

Unit-I

1-What do you mean by manufacturing process? Give the classification of manufacturing processes in detail?

2- a) What is pattern? Enlist its various types.
b) Enlist various types of pattern materials in detail.

3-What is the function of allowances explain its various types with neat sketch in

detail?

4- a) Explain various types of moulding sands which are used in foundry.
b) Enlist various properties of moulding sand.

5- Explain any two sand test in detail

a. Clay content
b. Permeability test
c. Moisture content

6- a) Explain the various properties of moulding sands.
b) What is the purpose of core, core pin, chaplet explain.

7- Explain the detail working procedure of green sand moulding with neat sketch.

8- a) What is the difference between Hot chamber and Cold chamber casting explain.
b) Give the classification of various casting processes. Explain Shell-Mould casting with neat sketch.

9- What is casting defect? Explain any five types of casting defects with their remedies.

10- a) Explain the working principal of injection molding and its applications.
b) Explain the working principal of centrifugal casting and its applications.

11- Write the classification of furnaces? Explain the working of cupola furnace and give its advantages and disadvantages.

UNIT II

1-a) Give the detail classification of various welding processes.
b) Write short note on welding, soldering, brazing and braze welding.

2-Write short note on:
a) Plasma arc welding
b) Electron beam welding.

3- Explain SMAW process in detail with its advantages and disadvantages.

4- Explain in detail GMAW process. Also give its advantages and disadvantages.

5-What is LASER? Explain laser welding with its advantages and disadvantages.

6-Explain the working principal of
a) SAW process
b) MAG welding process

7- a) Describe the types of flame obtained in oxy- acetylene gas welding process giving the applications.
b) Explain the working principal of Thermit welding.

8- How the cast iron hook or anchor repair by welding explain.

9- What is resistance welding? Draw a sketch to illustrate a typical technique used to obtain heat balance in spot welding of dissimilar metals.

10- a) What are the various materials use for electrode coating enlist.
b) Explain friction welding with neat sketch.

UNIT III

1- a) Differentiate elastic and plastic deformation of metal.
b) What are the main characteristics of hot working as compared to cold working processes?

2- a) Define forging, upsetting, edging, punching operations
b) What are the advantage and limitations of hot rolling

3- a) Explain following forming processes extrusion, wire and tube drawing processes.
b) What do you understand by term strain hardening explain.

4- What are the various causes of forming process defects explain also explain its various types.

5- a) Explain cold working process as squeezing, coining, embossing, and piercing.
b) Explain the working principal of hot rolling process with neat sketch

6- a) What is "grain flow" in forming process.

b) Distinguish between wire drawing and tube drawing with sketches

7- a) Explain with neat sketches of upsetting and drawing operations
b) What is extrusion and embossing process explain with neat sketch.

8- Explain the working principal of pneumatic hammer.

9- What do you understand by term forging hammer and press

10- Explain various types of forging tool with neat sketch.

11- Explain the term hot and cold forging in detail also enlist various process

UNIT-IV

1- What is powder metallurgy? Brief the importance of powder metallurgy.

2- What is sintering? Explain its various types.

3- What is atomization? Explain its various methods for making of metal powder.

4- What are the various properties of metal powder explain in detail.

5- What are the various advantage, disadvantages and application of powder metallurgy?

6- a) Describe the process of blending, compacting and sintering in powder metallurgy.
b) List the advantage, disadvantage and application of powder metallurgy

7- a) Why we introduce rapid prototyping in our manufacturing system explain the history.
b) Enlist the advantages, disadvantages and application of rapid prototyping.

8- Explain subtractive processes, additive processes in detail

9- Enlist various rapid prototyping processes? Explain FDM process in detail.

10- What are the future aspects of rapid prototyping as compare to other manufacturing process explain in detail

Unit V

1- What is plastic? Give detail classification of plastic.

2- Explain various Ingredients of plastic moulding compounds.

3- Discuss general properties of plastics and resins.

4- a) Give the detail classification of plastic moulding process?
b) Write short notes on following:
i) Compression moulding of plastics ii) Injection moulding of plastics

5- Explain with neat sketch injection moulding process with its application

6- Explain the term extrusion moulding in detail.

7- Write short note on following:
i) Blow moulding ii) Laminating

8- What is thermosetting and thermoplastic polymers explain in detail.

9- Write short note on:
a) Slush moulding b) Calendaring

10- Give the advantages, disadvantages and application of plastic technology.

JAGANNATH UNIVERSITY,JAIPUR

QUESTIONS BANK

Sub:-Design of Machine Element-I (ME 406)

UNIT-1

1. Explain the General Considerations in Machine Design.
2. Enumerate the various manufacturing methods of machine parts which a designer should know.
3. What are the factors to be considered for the selection of materials for the design of machine elements? Discuss.
4. How do you classify materials for engineering use.
5. What is fit and explain the various types of fit with neat sketch.
6. Explain Hole basis system and Shaft basis system.
7. Describe the design of casting.
8. Calculate the tolerance and fundamental deviation of sizes for the shaft Designated as 12H8/e8 ($e=-11(D)^{0.41}$).
9. Calculate the tolerances, fundamental deviations and limits of sizes for the shaft designated as 40 H8 / f7.
10 A journal of nominal or basic size of 75 mm runs in a bearing with close running fit. Find the limits of shaft and bearing. What is the maximum and minimum clearance.

UNIT-2

1. What is stress concentration? How can we reduce the effect of stress concentration.

2. What is endurance limit and factor affecting the endurance limit.

3. What do you mean by factor of safety?

4. Explain the following terms
(a) Endurance limit, (b) Size factor, (c) Surface finish factor, and (d) Notch sensitivity.

5. What is meant by `stress concentration? How the stress concentration in a component can be reduced.

6. A simply supported beam has a concentrated load at the centre which fluctuates from a value of P to 4 P. The span of the beam is 500 mm and its cross-section is circular with a diameter of 60 mm. Taking for the beam material an ultimate stress of 700 MPa, a yield stress of 500MPa, endurance limit of 330 MPa for reversed bending, and a factor of safety of 1.3, calculate the maximum value of P. Take a size factor of 0.85 and a surface finish factor of 0.9.

7. Design a knuckle joint to transmit 150 kN. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression.

8. Design and draw a cotter joint to support a load varying from 30 kN in compression to 30 kN in tension. The material used is carbon steel for which the following allowable stresses may be used. The load is applied statically.
Tensile stress = compressive stress = 50 MPa ; shear stress = 35 MPa and crushing stress = 90 MPa.

9. Distinguish between cotter joint and knuckle joint.

10. Design a cotter joint to connect two mild steel rods for a pull of 30 kN. The maximum permissible stresses are 55 MPa in tension ; 40 MPa in shear and 70 MPa in crushing. Draw a neat sketch of the joint designed.

UNIT-3

1. A simply supported beam has a concentrated load at the centre which fluctuates from a value of P to 4 P. The span of the beam is 500 mm and its cross-section is circular with a diameter of 60 mm. Taking for the beam material an ultimate stress of 700 MPa, a yield stress of 500 MPa, endurance limit of 330 MPa for reversed bending, and a factor of safety of 1.3, calculate the maximum value of P. Take a size factor of 0.85 and a surface finish factor of 0.9

2. What is a lever ? Explain the principle on which it works.

3. Explain the design procedure of a lever for a lever safety valve

4. Design a right angled bell crank lever. The horizontal arm is 500 mm long and a load of 4.5 kN acts vertically downward through a pin in the forked end of this arm. At the end of the 150 mm long arm which is perpendicular to the 500 mm long arm, a force P act at right angles to the axis of 150 mm arm through a pin into a forked end. The lever consists of forged steel material and a pin at the fulcrum. Take the following data for both the pins and lever material:
Safe stress in tension = 75 MPa
Safe stress in shear = 60 MPa
Safe bearing pressure on pins = 10 N/mm2.

5. A lever loaded safety valve is 70 mm in diameter and is to be designed for a boiler to blow-off at pressure of 1 N/mm2 gauge. Design a suitable mild steel lever of rectangular cross-section using the following permissible tresses Tensile stress = 70 MPa; Shear stress = 50 MPa; Bearing pressure intensity = 25 N/mm^2. The pin is also made of mild steel. The distance from the fulcrum to the weight of the lever is 880 mm and the distance between the fulcrum and pin connecting the valve spindle links to the lever is 80 mm

6. What do you understand by full length and graduated leaves of a leaf spring? Write the expression for determining the stress and deflection in full length and graduated leaves.

7. What is nipping in a leaf spring? Discuss its role. List the materials commonly used for the manufacture of the leaf springs .

8. Design a leaf spring for the following specifications :
Total load = 140 kN ; Number of springs supporting the load = 4 ; Maximum number of leaves = 10; Span of the spring = 1000 mm ; Permissible deflection = 80 mm. Take Young's modulus, E = 200 kN/mm2 and allowable stress in spring material as 600 MPa.

9. locomotive semi-elliptical laminated spring has an overall length of 1 m and sustains a load of 70 kN at its centre. The spring has 3 full length leaves and 15 graduated leaves with a central band of 100 mm width. All the leaves are to be stressed to 400 MPa, when fully loaded. The ratio of the total spring depth to that of width is 2. E = 210 kN/mm2. Determine :
1. The thickness and width of the leaves.
2. The initial gap that should be provided between the full length and graduated leaves before the band load is applied.
3. The load exerted on the band after the spring is assembled.

10 A truck spring has 12 number of leaves, two of which are full length leaves. The spring supports are 1.05 m apart and the central band is 85 mm wide. The central load is to be 5.4 kN with a permissible stress of 280 MPa. Determine the thickness and width of the steel spring leaves. The ratio of the total depth to the width of the spring is 3. Also determine the deflection of the spring.

Unit-4

1 How are the keys classified? Draw neat sketches of different types of keys and state their applications.

2. What is the effect of keyway cut into the shaft?

3. Describe, with the help of neat sketches, the types of various shaft couplings mentioning the uses of each type.

4. What are flexible couplings and what are their applications? Illustrate your answer with suitable examples and sketches.

5. Design and make a neat dimensioned sketch of a muff coupling which is used to connect two steel shafts transmitting 40 kW at 350 r.p.m. The material for the shafts and key is plain carbon steel for which allowable shear and crushing stresses may be taken as 40 MPa and 80 MPa respectively. The material for the muff is cast iron for which the allowable shear stress may be assumed as 15 MPa.

6. Design a clamp coupling to transmit 30 kW at 100 r.p.m. The allowable shear stress for the shaft and key is 40 MPa and the number of bolts connecting the two halves are six. The permissible tensile stress for the bolts is 70 MPa. The coefficient of friction between the muff and the shaft surface may be taken as 0.3

7. Design and draw a protective type of cast iron flange coupling for a steel shaft transmitting 15 kW at 200 r.p.m. and having an allowable shear stress of 40 MPa. The working stress in the bolts should not exceed 30 MPa. Assume that the same material is used for shaft and key and that the crushing stress is twice the value of its shear stress. The maximum torque is 25% greater than the full load torque. The shear stress for cast iron is 14 MPa

8. Design a rigid flange coupling to transmit a torque of 250 N-m between two coaxial shafts. The shaft is made of alloy steel, flanges out of cast iron and bolts out of steel. Four bolts are used to couple the flanges. The shafts are keyed to the flange hub. The permissible stresses are given below:
Shear stress on shaft =100 MPa
Bearing or crushing stress on shaft =250 MPa
Shear stress on keys =100 MPa
Bearing stress on keys =250 MPa
Shearing stress on cast iron =200 MPa
Shear stress on bolts =100 MPa

After designing the various elements, make a neat sketch of the assembly indicating the important dimensions. The stresses developed in the various members may be checked if thumb rules are used for fixing the dimensions.

9. The shaft and the flange of a marine engine are to be designed for flange coupling, in which the flange is forged on the end of the shaft. The following particulars are to be considered in the design :
Power of the engine = 3 MW
Speed of the engine = 100 r.p.m.
Permissible shear stress in bolts and shaft = 60 MPa
Number of bolts used = 8
Pitch circle diameter of bolts = 1.6 × Diameter of shaft
Find : 1. diameter of shaft ; 2. diameter of bolts ; 3. thickness of flange ; and 4. diameter of flange.

10 Design a bushed-pin type of flexible coupling to connect a pump shaft to a motor shaft transmitting 32 kW at 960 r.p.m. The overall torque is 20 percent more than mean torque. The material properties are as follows :
(a) The allowable shear and crushing stress for shaft and key material is 40 MPa and 80 MPa respectively.
(b) The allowable shear stress for cast iron is 15 MPa.
(c) The allowable bearing pressure for rubber bush is 0.8 N/mm2.
(d) The material of the pin is same as that of shaft and key. Draw neat sketch of the coupling.

UNIT-5
1. How the shaft is designed when it is subjected to twisting moment only.

2. Define equivalent twisting moment and equivalent bending moment. State when these two terms are used in design of shafts.

3. A solid steel shaft is supported on two bearings 1.8 m apart and rotates at 250 r.p.m. A 20° involute gear D, 300 mm diameter is keyed to the shaft at a distance of 150 mm to the left on the right hand bearing. Two pulleys B and C are located on the shaft at distances of 600 mm and 1350 mm respectively to the right of the left hand bearing. The diameters of the pulleys B and C are 750 mm and 600 mm respectively. 30 kW is supplied to the gear, out of which 18.75 kW is taken off at the pulley C and 11.25 kW from pulley B. The drive from B is vertically downward while from C the drive is downward at an angle of 60° to the horizontal. In both cases the belt tension ratio is 2 and the angle of lap is 180°. The combined fatigue and shock factors for torsion and bending may be taken as 1.5 and 2 respectively. Design a suitable shaft taking working stress to be 42 MPa in shear and 84 MPa in tension.

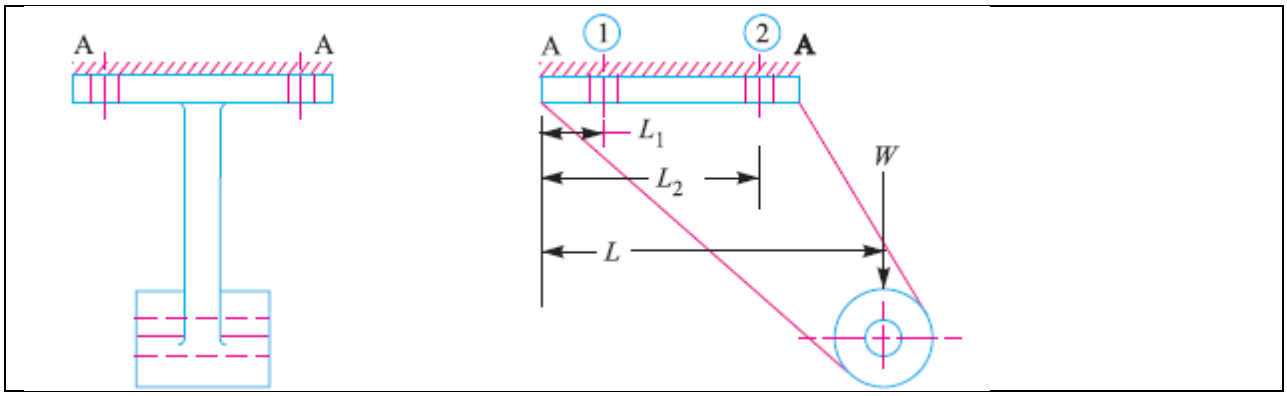
4. A mild steel shaft transmits 20 kW at 200 r.p.m. It carries a central load of 900 N and is simply supported between the bearings 2.5 metres apart. Determine the size of the shaft, if the allowable shear stress is 42 MPa and the maximum tensile or compressive stress is not to exceed 56 MPa. What size of the shaft will be required, if it is subjected to gradually applied loads?

5. A horizontal nickel steel shaft rests on two bearings, A at the left and B at the right end and carries two gears C and D located at distances of 250 mm and 400 mm respectively from the centre line of the left and right bearings. The pitch diameter of the gear C is 600 mm and that of gear D is 200 mm. The distance between the centre line of the bearings is 2400 mm. The shaft transmits 20 kW at 120 r.p.m. The power is delivered to the shaft at gear C and is taken out at gear D in such a manner that the tooth pressure F_{tc} of the gear C and F_{td} of the gear D act Vertically downwards. Find the diameter of the shaft, if the working stress is 100 MPa in tension and 56 MPa in shear. The gears C and D weighs 950 N and 350 N respectively. The combined shock and fatigue factors for bending and torsion may be taken as 1.5 and 1.2 respectively.

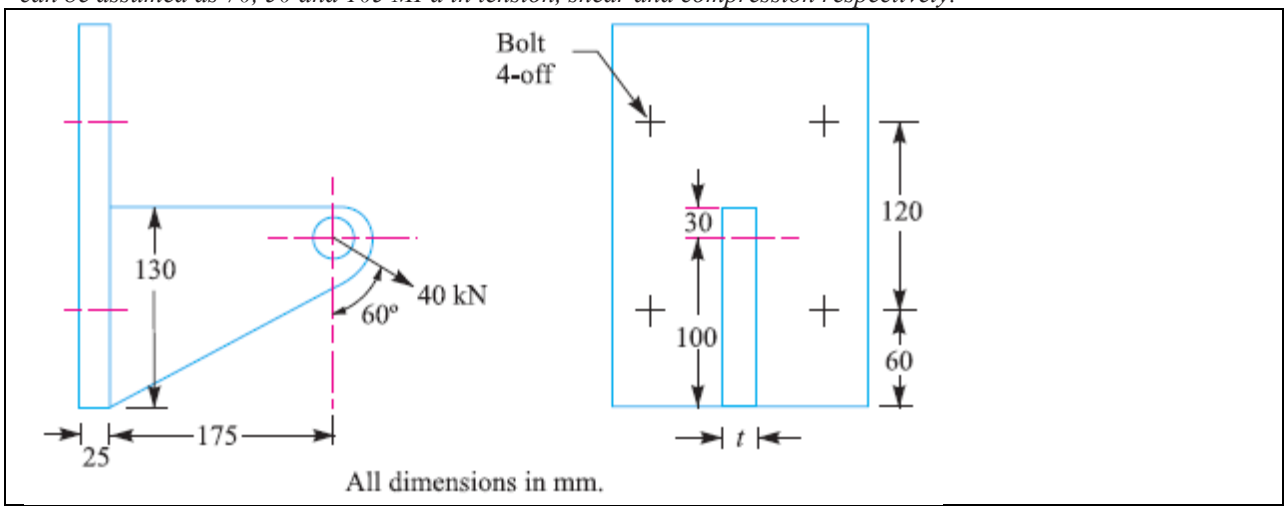
6. Explane the eccentric load action acting parallel to the axis of the bolts.

7. Explain the eccentric load action acting perpendicular to the axis of the bolts.

8. A bracket, as shown in Fig. supports a load of 30 kN. Determine the size of bolts, if the maximum allowable tensile stress in the bolt material is 60 MPa. The distances are : L1 = 80 mm, L2 = 250 mm, and L = 500mm.



9. *Determine the size of the bolts and the thickness of the arm for the bracket as shown in Fig, if it carries a load of 40 kN at an angle of 60° to the vertical. The material of the bracket and the bolts is same for which the safe stresses can be assumed as 70, 50 and 105 MPa in tension, shear and compression respectively.*



ME 501

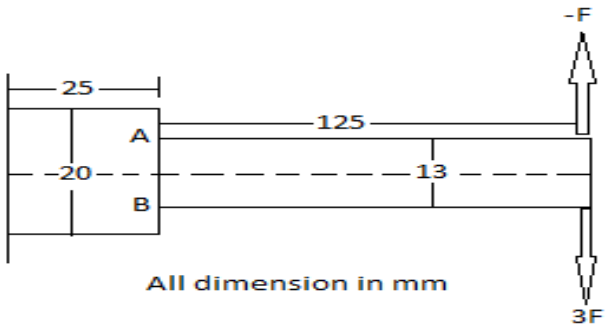
UNIT-I

Q1 A circular bar of 500mm length is Supported freely at its two end. It is acted upon by a central concentrated cyclic load having a minimum value of 20KN and a maximum value of 50KN. Determine the diameter of a bar by taking a factor of safety of 1.5, Size effect of 0.85, surface finish factor of 0.9.the material properties of bar are given by: Ultimate strength of 650Mpa, yield strength of 500mpa end Endurance strength of 350 Mpa.

Q2 A cantilever beam made of cold drawn carbon steel of circular cross section as shown in fig. is subjected to load which varies from –F to 3F. Determine the maximum load that member can withstand for an indefinite life using a F.S. = 2. The theoretical stress concentration factor is 1.42 and the notch sensitivity is 0.9.

Assume the following values:

Yield stress=550MPa, Ultimate stress=470MPa, Endurance limit=275MPa, Size factor=0.85, Surface finish factor=0.89



Q3. A forged steel bar 50 mm in diameter, is subjected to reversed bending stress of 250 N/mm2. The bar is made of steel 40C8 (Sut = 600 N/mm2). Calculate the life of the bar for a reliability of 90%. Assume the Following values- [ka=0.44, kb=0.85 & kc=0.897].

Q4 A simply supported beam has a concentrated load at the center which fluctuates from a value of P to 4P. The span of the beam is 5000mmand its cross-section is circular with a diameter of 60mm. Taking for the beam material an ultimate stress of the 700Mpa, a yield stress of 500 Mpa, endurance limit of 330Mpa for reversed banding, and a factor of safety of 1.3, Calculate the maximum value of P Take a Size factor of 0.85 and a surface finish factor of 0.9.

What is meant by endurance strength of a material? How do the size and surface condition of a component and type of load affect such strength?

Q5 What is meant by endurance strength of a material? How do the size and surface condition of a component and type of load affect such strength?

Q6 Explain the following terms in connection with design of machine members subjected to variable loads:

(a)Endurance limit, (b) Notch sensitivity

(c) Surface finish factor, and (d) size factor

Q7 Illustrate how the stress concentration in a component can be reduced.

Q8 Explain how the factor of safety is determined under steady and varying loading by different methods

Q9 A steel rod is subjected to a reversed axial load of 180 kN. Find the diameter of the rod for a factor of safety of 2. Neglect column action. The material has an ultimate tensile strength of 1070 Mpa and yield strength of 910 Mpa. The endurance limit in reversed bending may be assumed to be one-half of the ultimate tensile strength. Other correction factors may be taken as follows:

For axial loading = 0.7; For machined surface = 0.8 ; For size = 0.85 ; For stress

Concentration = 1.0.

Q10 Determine the diameter of a circular rod made of ductile material with a fatigue strength (complete stress reversal), σ_e = 265 MPa and a tensile yield strength of 350 MPa. The member is subjected to a varying axial load from Wmin = – 300 × 103 N to Wmax = 700 × 103 N and has a stress concentration factor = 1.8. Use factor of safety as 2.0.

UNIT-II

Q1 An overhung pulley transmits 35KW at 240 r.p.m. the belt derive is vertical and the angle of wrap may be taken as 180. The distance of pulley center line from the nearest bearing 350mm.μ=0.25 Determine:

(1)Diameter of pulley

(2)Width of the belt assuming thickness of 10mm

(3)Diameter of the shaft

(4)Dimensions of the key for securing the pulley on to the shaft and

(5)Size of arms six in number

The section of the arm may be taken as elliptical, the major axis being twice the minor axis. The following stresses may be taken for design purposes:

Shaft} tension and compression ----------80Mpa

Key} Shear ----------50Mpa

Belt: Tension ----------2.5Mpa

Pulley rim: Tension----------4.5Mpa

Pulley arms: Tension----------15Mpa

Q.2 Two pulleys, one 450mm dia. and the other 200mm dia. on parallel shaft 1.95m apart are connected by a crossed belt. Find the length of the belt required and angle of contact between belt and each pulley. What power can be transmitted by the belt when the larger pulley rotates at 200 r.p.m if the maximum tension in the belt is 1000N, and the coefficient of friction between the belt and the pulley is 0.25

Q.3 A belt drive consists of two v-belts in parallel, on grooved pulleys of the same size. The angle of the groove is 300. The cross sectional area of each belt is 750mm2 and μ=.12. The density of the belt material is 1.2 Mg/mm3 and the maximum safe stress in the material is 7MPa. Calculate the power that can be transmitted between pulleys of 300mm diameter rotating at 1500 r.p.m, find also the shaft speed in r.p.m at which the power transmitted would be maximum.

Q.4 A helical spring is made from a wire of 6mm diameter and has outside diameter of 75mm. if the permissible shear stress of 350 MPa and modulus of rigidity 84 kN/mm2, find the axial load which the spring can carry and the deflection per active turn.

Q5 A pulley of 0.9 m diameter revolving at 200 r.p.m. is to transmit 7.5 KW .find the width of the leather belt if the maximum tension is not to exceed 145N in 10mm width. The tension in the tight side is twice that in the slack side. Determine the diameter of the shaft and the dimensions of the various parts of the pulley, assuming it to have six arms. Maximum shear stress is not to exceed 63Mpa.

Q6 Design a helical spring for a spring loaded safety valve (Rams bottom safety valve) for the following conditions: Diameter of valve seat =65mm; Operating pressure =0.7 N/mm²; Maximum pressure when the valve blow off freely =0.75 N/mm²; maximum lift of the valve when the pressure rises from 0.7 to 7.5 N/mm²=3.5mm; Maximum allowable stress =550Mpa; Modulus of rigidity =84 KN/mm²; spring index =6;

Q7 A rope drive is to transmit 250 kW from a pulley of 1.2 m diameter, running at a speed of 300 r.p.m. The angle of lap may be taken as π radians. The groove half angle is 22.5°. The ropes to be used are 50 mm in diameter. The mass of the rope is 1.3 kg per meter length and each rope has a maximum pull of 2.2 kN, the coefficient of friction between rope and pulley is 0.3. Determine the number of ropes required. If the overhang of the pulley is 0.5 m, suggest suitable size for the pulley shaft if it is made of steel with a shear stress of 40 Mpa

Q8 Design a chain drive to actuate a compressor from 15 kW electric motor running at 1000 r.p.m., the compressor speed being 350 r.p.m. The minimum centre distance is 500 mm. The compressor operates 16 hours per day. The chain tension may be adjusted by shifting the motor on slides

Q9 Design a rubber belt to drive a dynamo generating 20 kW at 2250 r.p.m. and fitted with a pulley 200 mm diameter. Assume dynamo efficiency to be 85%.

Allowable stress for belt= 2.1 MPa

Density of rubber= 1000 kg / m3

Angle of contact for dynamo pulley= 165°

Coefficient of friction between belt and pulley = 0.3

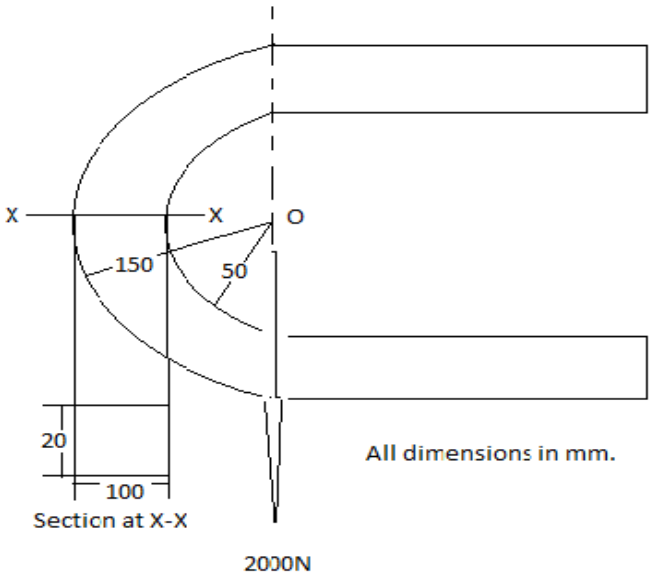
Q10 A leather belt 9 mm × 250 mm is used to drive a cast iron pulley 900 mm in diameter at 336 r.p.m. If the active arc on the smaller pulley is 120° and the stress in tight side is 2 MPa, find the power capacity of the belt. The density of leather may be taken as 980 kg/m3, and the coefficient of friction of leather on cast iron is 0.35.

UNIT-III

Q.1 A screw jack is to lift a load of 80kn through a height of 400mm. the elastic strength of screw material in tension and compression is 200mpa and in shear 120mpa. The material for nut is phosphor –bronze for which the elastic limit may be taken as 100mpa in tension, 90mpa in compression and 80mpa in shear the bearing pressure between the nut and the screw is not to exceed to 18n/mm2 .Design and draw the screw jack. The design should include the design of 1. Screw, 2.nut, 3. Handle and cup, and 4.body.

Q2Write the Design procedure of screw jack and draw the neat sketch of the same.

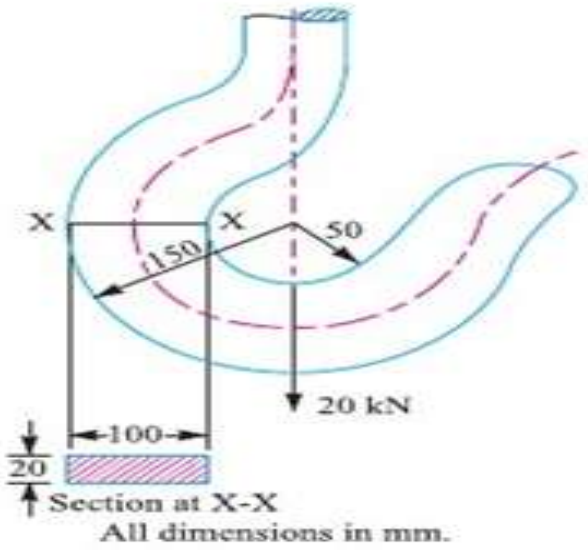
Q3 the frame of punch press is shown in Figure. Find the stresses at the inner and outer surface at the section X-X of the frame, if W=2000 N.



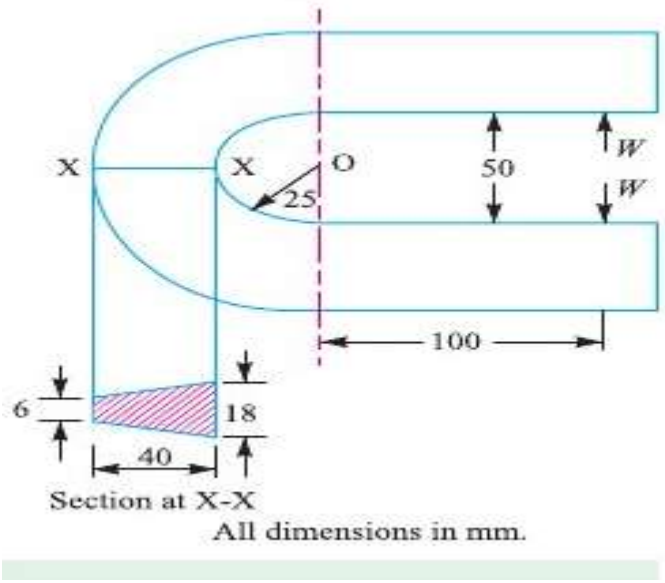
$R_n = h/\log_e (R_o/R_i)$

$R = R_i + h/2$

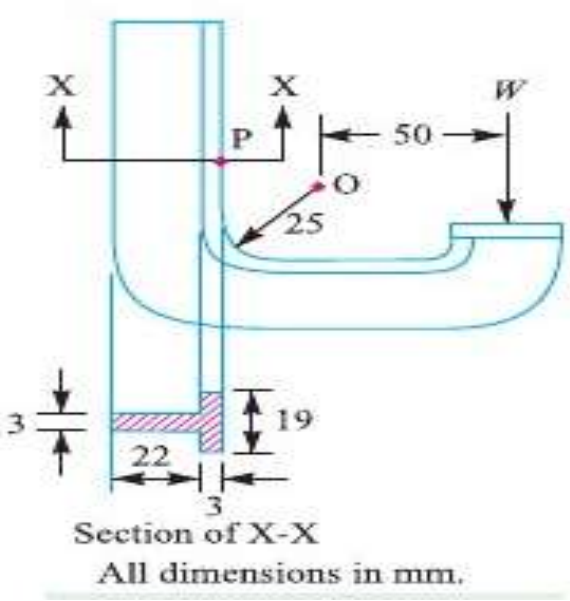
Q4 the crane hook carries a load of 20 kN as shown in Fig. The section at X-X is rectangular whose horizontal side is 100 mm. Find the stresses in the inner and outer fibers at the given section.



Q5 The frame of a punch press is shown in Fig. 5.9. Find the stresses at the inner and outer surface at section X-X of the frame, if W = 5000 N.



Q6 A C-clamp is subjected to a maximum load of W, as shown in Fig. If the maximum tensile stress in the clamp is limited to 140 Mpa, find the value of load W.



Q7 A vertical screw with single start square threads of 50 mm mean diameter and 12.5 mm pitch is raised against a load of 10 kN by means of a hand wheel, the boss of which is threaded to act as a nut. The axial load is taken up by a thrust collar which supports the wheel boss and has a mean diameter of 60 mm. The coefficient of friction is 0.15 for the screw and 0.18 for the collar. If the tangential force applied by each hand to the wheel is 100 N, find suitable diameter of the hand wheel.

Q8 An electric motor driven power screw moves a nut in a horizontal plane against a force of 75 kN at a speed of 300 mm / min. The screw has a single square thread of 6 mm pitch on a major diameter of 40 mm. The coefficient of friction at screw threads is 0.1. Estimate power of the motor.

Q9 A vertical two start square threaded screw of a 100 mm mean diameter and 20 mm pitch supports a vertical load of 18 kN. The axial thrust on the screw is taken by a collar bearing of 250 mm outside diameter and 100 mm inside diameter. Find the force required at the end of a lever which is 400 mm long in order to lift and lower the load. The coefficient of friction for the vertical screw and nut is 0.15 and that for collar bearing is 0.20.

Q10 The mean diameter of the square threaded screw having pitch of 10 mm is 50 mm. A load of 20 kN is lifted through a distance of 170 mm. Find the work done in lifting the load and the efficiency of the screw, when

1. The load rotates with the screw, and
2. The load rests on the loose head which does not rotate with the screw.

The external and internal diameter of the bearing surface of the loose head are 60 mm and 10 mm respectively. The coefficient of friction for the screw and the bearing surface may be taken as 0.08.

UNIT-IV

Q1 Make sketches to show the pressure distribution in a journal bearing with thick film lubrication in axial and along the circumference

Q2 Write short note on the lubricants used in sliding contact bearings Lubrication?

Q3 what is meant by hydrodynamic ?

Q 4 Write the design procedure of the journal bearing.

Q5A 80mm long journal bearing support a load of 2800N on a50mm diameter shaft. The bearing has a radial clearance of 0.05mm and the viscosity of the oil is 0.021 kg/m-s the operating temperature .if the bearing is capable of dissipating 80J/S. Determine maximum safe speed.

Q6 The load on the journal bearing is 150 kN due to turbine shaft of 300 mm diameter running at 1800 r.p.m. Determine the following:

1. Length of the bearing if the allowable bearing pressure is 1.6 N/mm2, and
2. Amount of heat to be removed by the lubricant per minute if the bearing temperature is

60°C and viscosity of the oil at 60°C is 0.02 kg/m-s and the bearing clearance is 0.25 mm.

Q7 Design a journal bearing for a centrifugal pump from the following data:

Load on the journal = 20 000 N; Speed of the journal = 900 r.p.m.; Type of oil is SAE 10, for

Which the absolute viscosity at 55°C = 0.017 kg / m-s; Ambient temperature of oil = 15.5°C; Maximum bearing pressure for the pump = 1.5 N / mm2.

Calculate also mass of the lubricating oil required for artificial cooling, if rise of temperature of oil be limited to 10°C. Heat dissipation coefficient = 1232 W/m2/°C.

Q8 A full journal bearing of 50 mm diameter and 100 mm long has a bearing Pressure of 1.4 N/mm2. The speed of the journal is 900 r.p.m. and the ratio of journal diameter to the diametral clearance is 1000. The bearing is lubricated with oil whose absolute viscosity at the Operating temperature of 75°C may be taken as 0.011 kg/m-s. The room temperature is 35°C. Find:1. The amount of artificial cooling required, and 2. The mass of the lubricating oil required, if the difference between the outlet and inlet temperature of the oil is 10°C. Take specific heat of the oil as1850 J / kg / °C.

Q9. A 150 mm diameter shaft supporting a load of 10 kN has a speed of 1500 r.p.m. The shaft runs in a bearing whose length is 1.5 times the shaft diameter. If the diametral Clearance of the bearing is 0.15 mm and the absolute viscosity of the oil at the operating temperature is 0.011 kg/m-s, find the power wasted in friction.

Q10 The thrust of propeller shaft in a marine engine is taken up by a number of collars Integral with the shaft which is 300 mm is diameter. The thrust on the shaft is 200 kN and the speed is 75 r.p.m. Taking □constant and equal to 0.05 and assuming the bearing pressure as uniform and equal to 0.3 N/mm2, find :

1. Number of collars required,
2. Power lost in friction, and 3. Heat generated at the bearing in kJ/min.

UNIT-V

Q1 the following particulars of a single reduction spur gear are given:

Gear ratio = 10: 1; Distance between centers = 660 mm approximately; Pinion transmits 500 KW at 1800 r.p.m.; Involute teeth of standard proportions (addendum = m) with pressure angle of 22.5°; Permissible normal pressure between teeth = 175 N per mm of width. Find:

1. The nearest standard module if no interference is to occur;
2. The number of teeth on each wheel;
3. The necessary width of the pinion; and
4. The load on the bearings of the wheels due to power transmitted.

Q 2 A bronze spur pinion rotating at 600 r.p.m. drives a cast iron spur gear at a transmission ratio of 4: 1. The allowable static stresses for the bronze pinion and cast iron gear are 84 Mpa and 105 Mpa respectively. The pinion has 16 standard 20° full depth involute teeth of module 8 mm. The face width ofboth the gears is 90 mm. Find the power that can be transmitted from the standpoint of strength.

Q3 A gear drive is required to transmit a maximum power of 22.5KW. the velocity ratio is 1:2 and r.p.m. of the pinion is 200 the approximate center distance between the shaft may be taken as 600mm. the teeth has 200 stub involute profiles. The static stress for the gear material (which is cast iron) may be taken as 60Mpa and face width as 10times the module. Find the module, face width and number of teeth on each gear. Check the design for dynamic and wear loads. The deformation or dynamic factor in the Buckingham equation may be taken as 80 and the material combination factor for the wear as1.4

Q4 Design a pair of helical gears for transmitting 22KW. The speed of the driver gear is 1800r.p.m. and that of driven gear is 600 r.p.m. the helices angle is 300and profile is corresponding to 200 full depth systems. The driver gear has 24teeth.both the gear is made of cast steel with allowable static stress as 50Mpa. Assume the face width parallel to axis as 4time the circular pitch and the overhang for each gear as 150mm. the allowable shear stress for the shaft material may be taken as 50Mpa.the form factor may be taken as 0.154-0.912/TE Where TE is the equivalent number of teeth. The velocity factor may be taken as 350/(350+v), where v is pitch line velocity in m/min. the gears are required to be designed only against bending failure of the teeth under dynamic condition.

Q5 A pair of helical gears is to transmit 15 kW. The teeth are 20° stub in diametric plane and have a helix angle of 45°. The pinion runs at 10 000 r.p.m. and has 80 mm pitch diameter. The gear has 320 mm pitch diameter. If the gears are made of cast steel having allowable static Strength of 100 Mpa; determine a suitable module and face width from static strength considerations and check the gears for wear, given σ_{es} = 618 Mpa.

Q6 Design a pair of helical gears for transmitting 22 kW. The speed of the driver gear is 1800 r.p.m. and that of driven gear is 600 r.p.m. The helix angle is 30° and profile is corresponding to 20° full depth system. The driver gear has 24 teeth. Both the gears are made of cast steel with allowable static stress as 50 MPa. Assume the face width parallel to axis as 4 times the circular pitch and the overhang for each gear as 150 mm. The allowable shear stress for the shaft material may be taken as 50 MPa. The form factor may be taken as 0.154 – 0.912 / TE, where TE the equivalent number of teeth. The velocity factor may be taken as 350+V/350 , where v is pitch line velocity in m / min. The gears are required to be designed only against bending failure of the teeth under dynamic condition.

Q7 A motor shaft rotating at 1500 r.p.m. has to transmit 15 kW to a low speed shaft With a speed reduction of 3:1. The teeth are 14 1/2° involute with 25 teeth on the pinion. Both the pinion and gear are made of steel with a maximum safe stress of 200 Mpa. A safe stress of 40 Mpa may be taken for the shaft on which the gear is mounted and for the key.

Design a spur gear drive to suit the above conditions. Also sketch the spur gear drive. Assume starting torque to be 25% higher than the running torque.

Q8 A 35 kW motor running at 1200 r.p.m. drives a compressor at 780 r.p.m. Through a 90° bevel gearing arrangement. The pinion has 30 teeth. The pressure angle of teeth is 14 1/ 2 °. The wheels are capable of withstanding a dynamic stress,

$$\sigma_w = 140(\frac{280}{280+v}) \text{ Mpa,}$$

v is the pitch line speed in m / min. The form factor for teeth may be taken as $0.124 - \frac{0.686}{T_E}$ where TE is the number of teeth equivalent of a spur gear. The face width may be taken as ¼ of the slant height of pitch cone. Determine for the pinion, the module pitch, face width, addendum, dedendum , outside diameter and slant height.

Q9 A pair of cast iron bevel gears connects two shafts at right angles. The pitch diameters of the pinion and gear are 80 mm and 100 mm respectively. The tooth profiles of the gears are of 14 1/2º composite form. The allowable static stress for both the gears is 55 Mpa. If the pinion transmits 2.75 kW at 1100 r.p.m., find the module and number of teeth on each gear from the stand-Point of strength and check the design from the standpoint of wear. Take surface endurance limit as630 Mpa and modulus of elasticity for cast iron as 84 kN/mm2.

Q10 A pair of 20º full depth involute teeth bevel gears connect two shafts at right angles having velocity ratio 3: 1. The gear is made of cast steel having allowable static stress as 70 Mpa and the pinion is of steel with allowable static stress as 100 Mpa. The pinion transmits 37.5 kW at 750 r.p.m. Determine: 1. Module and face width; 2. Pitch diameters; and 3. Pinion shaft diameter. Assume tooth form factor, $0.154 - \frac{0.912}{T_E}$ where TE formative number of teeth, width = 1/3 rd.The length of pitch cone, and pinion shaft overhangs by 150 mm.

JAGANNATH UNIVERSITY,JAIPUR

Questions Bank

SUBJECT:-TURBO MACHINES (ME 502)

Unit 1

Q.1 (a) What do you understand by Turbo machines and give detailed classification of the same.

Q.2 Discuss in brief

(i) Efficiency of Turbo machines

(ii) Positive displacement machines

Q.3 (a) Derive Euler turbine equation

Q.4 (b) Write short notes on following

(i) Utilization factor.

(ii) Static and Stagnation States.

Q.5 Differentiate the Reaction and Impulse turbine with example.

Q.6 Justify the suitability of positive displacement with practical application.

Q.7 Show the T-S diagram for efficiency of Turbine and Compressor.

Q.8 Derive the relation for SFEE based on first law of Turbo machines.

Unit 2

Q.1 Discuss the role of centrifugal compressor and explain the working principal of the same with the help of diagram.

Q.2 A centrifugal pump delivers water against a head of 20 mtr at the rate of 100ltr/sec at the speed of 1500 rpm. The impeller diameter at outlet is 25 cm and width at outlet is 5cm. The manometric efficiency is 75%.Determine the blade angle at the outlet.

Q. 3 A centrifugal pump delivers 1800 ltr/sec water against a head of 20 mtr at the speed of 1450 rpm. The impeller diameter at inlet and outlet are 120 cm and 240 cm.

Diameter of suction and delivery pipe are both 100cm, Determine the blade angles at inlet(θ) and outlet(Φ).

Q.4 Write short notes on following

(i) Centrifugal pump efficiencies.

(ii)Performance characteristics curve for centrifugal pump

Q.5 Draw the velocity triangle of Centrifugal pump and derive the formula for work done by pump.

Q.6 Discuss the following

(i) Minimum starting speed of the pump.

(ii) Net positive suction head.

Q.7 The diameters of an impeller of a centrifugal pump at inlet and outlet are 30 cm and 60 cm respectively. Determine the minimum starting speed of the pump if it works against a head of 30 mtr.

Unit-3

Q.1 Focus the utility of centrifugal compressor and explain the working of the same with the help of diagram.

Q.2 A centrifugal compressor under test gave the following data, speed (N) = 11500 rpm, T1=21˚C ,P1=1 bar,P2=4 bar, impeller dia=75 cm . If the slip factor is 0.92 ,what is the compressor efficiency.

Q. 3 (a) Describe the following in detail.

(i) Surging and chocking

(ii) Power input factor and slip factor.

Q.4 Air at a temperature of 290 k , flows in a centrifugal compressor running at 20,000 rpm, slip factor=0.80,compressor efficiency=0.80,d2=0.60mtr.Assume that the absolute velocities at the inlet and outlet are same. Calculate (a) The temperature rise of air passing through compressor and (b) The stage pressure ratio.

Q.5 Draw the velocity triangle for centrifugal compressor and derive the relation for work done.

Q.6 Write short notes on following.

(i) Loading coefficient.

(ii) Pressure coefficient.

Q.7 Determine the impeller diameters and the width at the impeller exit and the power required to drive compressor, from the following data.

N=12500 , mass flow rate=15kg/sec , pressure ratio=4:1, compressor efficiency=75% , slip factor =0.9, flow coefficient=0.3, hub diameter of the eye=15cm, axial flow velocity of air at entry to exit from impeller=150m/sec, temperature at inlet=295K, pressure at inlet =1 bar

Q.8 Discuss the following.

(i) Degree of reaction

(ii) Rotating stall

Unit 4

Q. 1 An axial flow compressor having eight stages with 50% reaction design compressed air in the pressure ratio of 4:1. The air enters the compressor at 20° C and flow through it with a constant speed of 90 m/s. The rotating blades of compressor rotate with a mean speed of 180 m/s. Isentropic efficiency of the compressor may be taken as 82%. Calculate-

(i) Work done by the compressor.

(ii) Blade angles

Assume $\gamma = 1.4$ and $Cp = 1.005$

Q.2 Write short notes on –

(i) Choking and Surging

(ii) Slip Factor

Q.3 Draw the velocity triangle for Axial flow compressor and derive the relation for work done.

Q.4 Find the polytropic efficiency of an axial flow compressor from the following data:

The total head pressure ratio = 4:1

Overall total head isentropic efficiency = 85%

Total head inlet temperature =290k

The inlet and outlet air angles from the rotor blades of the above compressor are 10° and 45° respectively. The rotor stator blades are symmetrical. The mean blade speed and axial velocity remain constant throughout the compressor. Assuming a value of 220m/sec for blade speed and work done factor = 0.86, find the number of stages required. Also find the inlet Mach number relative to rotor at the mean blade height of the first stage. Assume R =284.6 KJ/kg k

Q.5 Explain the detailed steps which are considered in blade design calculation.

Q.6 A 50% reaction, axial flow compressor runs at a mean blade speed of 250 m/s. The pressure ratio developed by the machine is 1:3. Determine the blade and air angle if the mean flow velocity was 200 m/s . Condition at inlet are 1 bar and 300 k.

Q.7 Differentiate between the Turbine blades and Compressor blades.

Q.8 List out the advantages of Axial flow compressors over Centrifugal compressors.

Unit 5

Q.1 List out the component of Axial flow pump and explain the working of the same with the help of diagram.

Q.2 Explain the following

(i) Axial flow pump characteristics

(ii) Cavitation and precaution against cavitation

Q.3 Draw the velocity triangle for Axial flow pump and derive the relation for work done.

Q.4 Explain the practical justification of variation based on efficiency ,head, power Vs discharge with the help of graph.

Q.5 Discuss the following terms:

(i) Speed Ratio (Ku)

(ii) Flow Ratio (ǿ)

(iii) Specific speed (Ns)

Q.6 A axial flow pump has:

Discharge of the pump =200 lps

Head developed by the pump =3 mtr

Specific speed = 280

Speed ratio = 2.5

Flow ratio = 0.55

Determine following

Speed of the pump

Diameter of the impeller

Diameter of the boss or runner

Q.7 The impeller of a axial flow pump is 1.20 mtr in diameter, while the boss is 0.6 mtr in diameter. Find the most suitable speed to provide a head of 2.5 mtr . The velocity of flow through impeller is 4.5 m/sec and the specific speed of the pump is 335. Find also the vane angle at inlet and outlet.

Q.8 A axial flow pump designed to deliver 1m3/sec at 7 mtr head while running at 960 rpm. Its outer diameter is 50 cm and hub diameter is 25 cm. Find:

(i) Flow ratio

(ii) Speed ratio

(iii0 Power required , if overall efficiency is 0.84

Q.9 The following particulars are available regarding a propeller pump –

Discharge of the pump = 180 l/s

Head developed = 2 m

Specific speed = 250

Speed ratio = 2.40

Flow ratio = 0.50

Calculate –

(i) The speed of the pump

(ii)The runner diameter

JAGANNATH UNIVERSITY

Question bank

Sub:-Heat and Mass Transfer(ME503)

Unit-1

1. Define thermal conductivity, thermal resistance and thermal conductance?

2. Write the Fourier rate equation for heat transfer by conduction. Give the units ?

3. Derive the general conduction equation for cylindrical co-ordinates system being with uniform heat generation and unsteady state.

4. Explain the critical thickness of insulation.

5. A steam main 75mm inside diameter and 90mm outside diameter is lagged with two Successive layers of insulation. The layer in contact with the pipe is 38mm asbestos and the asbestos layer is covered with 25mm thick magnesia insulation. The surface coefficient for inside and outside surface are 227W/m2k and 6.8W/m2k respectively if the steam temperature is 3750C and the ambient temperature is 350C, calculate the steady state loss of heat from steam for 60m length of pipe.

6. A cable of 10mm outside is to be laid an atmosphere of 250C(h0=12.5w/m2-deg) and its surface temperature is likely to heat generated within it.how would the heat flow from the cable be affected if it is insulated with rubber having thermal conductivity k=12.5w/m-deg.

7. Consider a plane composite wall that is made of materials of thermal conductivities ka=735kJ/m-hr-deg, and kb=165kJ/m-hr-deg and thickness xa=5cm and xb=2.5cm. material A adjoins a hot fluid at 1500C for which ha=42kJ/m2-hr-deg and the material B is in contact with a cold fluid at 300C and h hb=85kJ/m2-hr-deg.calculate ;- (a) the rate of heat transfer through a wall which is 2m height and 2.5 m wide. (b) The overall coefficient of heat transfer.

8. A spherical vessel of insulated with 0.2 m thickness of insulation of thermal conductivity 0.04 w/m-deg.the surface temperature of vessel is -1950C and outside air is at 100C.Determine; (a) heat flow, (b) heat flow per m2 based on inside and outside area, (c) temperature gradient at the inner and outside surface.

9. Derive an expression for heat flow through a composite cylinder taking into account the film heat transfer coefficient on the inside and outside surface of the cylinder.

10. The inner and outer surfaces of a furnace wall,25cm thick are at 3000c and 300c respectively. the thermal conductivity of the wall material varies with temperature and is prescribed by the relation k=(1.45 + 0.5*10-5t2)kj/m-hr-deg. Where “t “ is the temperature in degree centigrade. Proceed from the basic principles to calculate the heat loss per square meter of the wall surface area.

Unit 2

1Derive the heat dissipation from a fin insulated at the tip .

2 A rod of 10mm square section and 160mm length with thermal conductivity of 50W/m-deg protrudes from a furnace wall at 2000C, and is exposed to air at 300C With convection coefficient 20W/m2-deg. Make calculation for the heat convection Up to 80mm and 158mm length and comment on the result. adopt along fin model for the arrangement.

3 Derive the heat dissipation from an infinitely long fin and fin efficiency.

4 A steel rod(k=30W/m-deg) 1cm in diameter and 5cm long protrudes from a wall Which is maintained at 1000C. the rod is insulated at its tips and is exposed to an Environment with h=50W/m2-deg and ta=300C. calculate the fin efficiency, temperature at the tip of fin and the rate of heat dissipation.

5. Explain fin performance: - (a) Efficiency of fin (b) Effectiveness of fin.

6. Under what condition does the fin efficiency become nearly 100

7. Explain the phenomenon of heat transfer by free convection.

8. Explain the phenomenon of heat transfer by forced convection.

9. Define the nusselt number.how it is related to temperature gradient in fluid immediately in contact with the solid surface.

10. Explain steady flow of heat along a rod.

Unit 3

1 Explain the Rayleigh method and the Buckingham,s π-theorem for dimensional Analysis.

2. Explain physical significance of dimensionless groups.

(a) Grashof number, (b) prandtl number, (c) Nusselt number, (d) Stanton number.

3 Explain the laminar flow for plane surfaces and cylindrical surfaces.

4 Calculate the rate of heat loss from a human body which may be considered as a Vertical cylinder 30cm in diameter, and 175 cm high white standing in a 30km/hr Wind at 150C. the surface temperature of the human is 350C.

5. Two horizontal steam mains with diameters 5cm and 15cm are so laid in a boiler house that any mutual heat effect is precluded. The mains are at the same surface temperature of 500˚c whilst the ambient air is at 50˚c.work out the ratio of the heat transfer coefficient, and of the losses from one metre length of mains

6. Estimate the heat transfer from a 40W incandescent bulb at 125˚c and 25˚c in quiescent air.Approximate the bulk as a 50mm diameter sphere. what percent of the power is lost by free convection.the appropriate correlation for the convection coefficient is Nu=0.60(Gr Pr)0.25 where the different parameters are evaluated at the mean film temperature, and the characteristic length is the diameter of the sphere.

7. Explain the newton – rikhman law; convection rate equation.

8. A heat treat steel plate measures 3m*1m and is initially at 300c. it is cooled by blowing air parallel to 1m edge at 9km/hr. if the air is at 100c, calculate the convective heat transfer from both side of the plate.

9. Explain the hydrodynamic boundary layer for flat plate.

10. Explain the thermal boundary layer for flat plate.

Unit 4

1 Dine the term overall heat transfer coefficient.

2 Derive the relationship between the effectiveness and number of transfer units for Parallel flow heat exchanger.

3. Derive the Logarithmic mean temperature difference.

4. In a food processing plant, a brine solution is heated from 120c to 650c in a double pipe Parallel flow heat exchanger by water entering at 350c and leaving at 20.50c at the rate of 9kg/min.Determine the heat exchanger area for an overall heat transfer coefficient of860W/m2K.For water CP=4.186*103J/kgK.

5 . What is a heat exchanger? How heat exchanger are classified.

6. What is mean by fouling factor? How does it affect the performance of a heat exchanger.

7. A steam condenser is transferring 250kw of thermal energy at a condensing temperature of 650c. the cooling water enters the condenser at 200c with a flow rate of 7500kg/hr. calculate the log mean temperature difference. if overall heat transfer coefficient for the condenser surface is 1250w/m2-deg,what surface area is required to handle this load.

8. A heat exchanger is to be designed to condense 8kg/s of an organic liquid(tsat=800c, hfg=600KJ/Kg) with cooling water available at 150c and at a flow rate of 60kg/s. the overall heat transfer coefficient is 480w/m2-deg.calculate the number of tubes required .the tubes are to be of 25mm outer diameter,2mm thickness and 4.85m length.

9. A heat exchanger with 2 shell passes and 4-tube passes is used to cool oil cp=3.55kJ/kgk)from 1250c to 500c, flowing at the rate of 2.5kg/s. the cooling water (cp=4.18kJ/kgk) enters the shell at 200c with a flow rate of 3kg/s and the overall heat transfer coefficient for the exchange has been estimated at 115w/m2k.calculate (a) heat transfer through the exchanger (b) correction factor for the multi arrangement and (c) heat transfer area to accomplish the specified energy transfer.

Unit 5

1. State and prove Kirchoff,s law of radiation.

2 State and prove Planck,s law of radiation.

3 Explain the terms absorptivity,reflectivity and transmissivity of the radiant energy.

4. Explain the salient features and characteristics of radiation.

5. Explain the configuration factor.

6. Explain heat exchange between non-black bodice for infinite parallel plane.

7. A steel rod of 20mm diameter has been mounted axially in a heat treatment muffle furnace of inside diameter 160mm.the inside surface temperature of the muffle is at 1360k and has an emissivity of .85, while the emissivity of the surface of the rod is 0.6.find the time required to heat the rod from 700k to 800k assuming that it occupies full length of the furnace. For the rod material, take specific heat as .65kj/kgk and the density as 7840kg/m3.

8. Two large parallel planes with emissivity 0.4 are maintained at different temperature and exchanger heat only by radiation. What percentage change in net radiation heat transfer would occur if two equally large radiation shield with surface emissivity 0.04 are introduced in parallel to the plates.

9. A 10mm outside diameter pipe carries a cryogenic fluid at 100k temperature. Another pipe of 13mm outside diameter and at 280k surrounds it coaxially and the space between the pipes is completely evacuated. Determine the radiant heat flow for 3m length of pipe if the surface emissivity for both surfaces is 0.2. proceed to calculate percentage reduction in heat flow if a shield of 11.5mm diameter and 0.05 surface emissivity is placed between the pipes.

JAGANNATH UNIVERSITY

Question Bank

Dynamics of Machines(ME504)

Unit-1 Toothed gearing

Q1. What do you understand by gears?

Q2. Classify all types of gears with diagram?

Q3. Explain the terminology of gears with diagram?

Q4. Prove law of gearing?

Q5. Derive a relation for length of path of contact?

Q6. Derive a relation for velocity of sliding?

Q7. Explain tooth profile of gears?

Q8. Derive relation for minimum no of teeth's on wheel and pinion to avoid interference?

Q9.A pinion having 30 teeth's drives a gear having 80 teeth. The profile of the gear is involutes with 20 pressure angle, 12 mm module and 10 mm addendum. Find the length of the path of the contact, arc of the contact and contact ratio.

Q10. A pair of involutes spur gear with 16 pressure angle and pitch of the module is 6mm is in mesh . The no of teeth on pinion is 16 and its rotational speed is 240 rpm. When the gear ratio is 1.75, find in order that the interference is just avoided; 1.the addenda on pinion and gear wheel; 2. The length of path of contact; 3. The max velocity of sliding of teeth on either side of the pitch point.

Unit-2 Gear train

Q1.what do you understand by gear train?

Q2. Explain all types of gear train with diagram?

Q3.Explain working of epicyclic gear train with diagram and example?

Q4.Explain tabular method to find out velocity ratio in epicyclic gear train?

Q5.explain algebraic method to find out velocity ratio of epicyclic gear train /

Q6.two parallel shafts, about 600mm apart are to be connected by spur gears. One shaft is to be run at 360 r.p.m and the other at 120 r.p.m. Design the gears, if the circular pitch is to be 25 mm.

Q7. In reverted epicyclic gear train, the arm A carries two gears B & C and a compound gear D-E. The gear B meshes with gear E and gear C meshes with gear D. the no of teeth on gear B, C and D are 75, 30 and 90 respectively. Find the speed and direction of gear C when gear B is fixed and the arm A makes 100 r.p.m. clockwise.

Q8. An epicyclic gear train consists of three gears A, B and C the gear A has 72 internal teeth and gear C has 32 external teeth. the gear B meshes with both A and C and is carried on arm EF which rotates about the centre of A at 18 r.p.m if the gear A is fixed , determine the speed of gear B and C.C is sun gear, B is planet gear

Q9. The speed ratio of the reverted gear train is to be 12. The module pitch of gears A and B is 3.125 mm and of the gears C and D is 2.5 mm. calculate the suitable numbers of teeth of gears. No gears are to have less than 24 teeth. A is driver and meshes with gear B.Gear D is driven gear and meshes with gear C.

Q10. Explain differential of the vehicle with diagram?

Unit-3 Governor

Q1.explain governor of engines with diagram?. Classify all types of governor with diagram of the basic governor?

Q2. Derive a relation for equilibrium speed and height of a watt governor?

Q3. Deriver a relation for equilibrium speed and height of porter governor?

Q4. Derive a relation for the height and equilibrium speed for proell governor by instantaneous method?

Q5. a porter governor has equal arms each 250 mm long and pivoted on the axis of the rotation . Each ball has a mass of 5 Kg and the mass of central load on the sleeve is 25 Kg. the radius of the rotation of the ball is 150 mm when the governor begins to lift and 200 mm when the governor is at maximum speed. find the min and max speeds and range of the speed of the governor.

Q6.a proell governor has equal arms of length 300 mm. the upper and lower ends of the arms are pivoted on the axis of the governor. The extension arms of the lower links are each 80 mm long and parallel to the axis when the radii of rotation of the balls 150mm and 200 mm. the mass of each ball is 10 Kg and the mass of the central load is 100 Kg. Determine the range of the speed of the governor.

Q7.Derive a relation for height and equilibrium speed of the porter governor by instantaneous method?

Q8.Derive a relation for stiffness of the spring for hartnell governor?

Q9. in a spring loaded hartnell type governor , the extremes radii of rotation of the balls are 80mm and 120 mm. the ball arm and sleeve arm of the bell crank ;lever are equal in length . the mass of the each ball is 2 Kg. if the speed of the two extreme position are 400 and 420 r.p.m., find 1; the initial compression of the central spring and 2; the spring constant.

Q10. Write differences between flywheel and governor?

Unit-4 Balancing

Q1.Explain balancing with its advantages and disadvantages?

Q2. Classify types of balancing explain them with neat diagram?

Q3. Four masses m1, m2, m3 and m4 are 200Kg, 300Kg, 240Kg and 260Kg respectively. The corresponding radii of rotation are .2m,.15m,.25m and .3m respectively and the angles between successive masses are 45,75, and 135 . Find the position and magnitude of their balance masses required, if its radius of rotation is .2m.

Q4. a shaft carries four masses A, B, C and D of magnitude 200 Kg , 300 Kg , 400 Kg and 200Kg respectively and revolving at radii 80 mm,70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400mm and 700mm. the angles between the cranks measured anticlockwise are A to B 45, B to C 70, and C to D 120. the balancing masses are to be placed in planes X and Y. the distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. if the balancing masses revolve at a radius of 100 mm, find their magnitude and angular positions.

Q5.A, B, C, and D are four masses carried by a rotating shaft at radii 100, 125,200 and 150mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the masses of B, C and D are 10Kg, 5Kg, 5Kg and 4Kg respectively. Find the required mass of A and the relative angular setting of the four masses so that the shaft can be in complete balance.

Q6. Explain balancing of reciprocating masses?

Q7. Drive a relation for primary unbalanced force of reciprocating masses

Q8.derive a relation for secondary unbalanced force of reciprocating masses?

Q9. Explain “swaying couple” and “hammer blow”?

Q10.The three crank of three cylinder locomotive are all on the same axle and are set at 120. The pitch of the cylinder is 1 meter and the stroke of the each piston is .6m. The reciprocating masses are 300 Kg for inside cylinder and 260 Kg for each outside cylinder and the planes of the rotation of the balance masses are .8 from the inside crank.

If 40% of the reciprocating parts are to be balanced, find:

1. The magnitude and the position of the balancing masses required at a radius of .6 m;
2. The hammer blow per wheel when the axle makes 6 r.p.s

Unit-5 Gyroscope

Q1. Explain gyroscopic couple in brief?

Q2.Explain with diagram

(a)plane of spinning

(b) Plane of precision

(c) Axis of active gyroscopic couple

(d) Plane of active gyroscopic couple

Q3. Explain the effect of gyroscopic couple on an aero plane

Q4. Explain the effect of gyroscopic couple on a naval ship during steering?

Q5. the mass of the turbine rotor of the ship is 20 tones and has a radii of gyration of .60 m. its speed is 2000 r.p.m. the ship pitches 6 above and 6 below the horizontal position . a complete oscillation takes 30 sec and the motion is simple harmonic .determine the following:

1. Max gyroscopic couple
2. Max angular acceleration of the ship during pitching 3. the direction in bow will tend to turn when rising , if the rotation of the rotor is clockwise when looking from the left .

Q6. Explain the effect of gyroscopic couple on a naval ship during pitching ?

Q7. Derive a relation for effect of gyroscopic couple and centrifugal couple on a four wheeler ?

Q8. A four wheel trolley car of mass 2500 Kg runs on rails , which are 1.5 m apart and travel around a curve of 30 m radius at 24 Km/h . the rails are at the same level. Each wheel of the trolley 0.75 m in diameter and each of the two axles is driven by a motor running in the direction opposite to that of wheels at a speed of five times the speed of rotation of the wheels. The moment of inertia of each wheel with gear and wheels is 18 Kg-m2. Each motor with shaft and gear pinion has moment of inertia of 12Kg-m2. The centre of gravity of the car is 0.9 m above the rail level. Determine the vertical force exerted by each wheels on the rails taking into consideration the centrifugal and gyroscopic effects. State the centrifugal and gyroscopic effects on the trolley.

Q9. Explain the effect of gyroscopic couple on two wheeler taking a turn?

Q10. Find the angle of inclination with respect to the vertical of the two wheeler negotiating the turn. given : combined mass of the vehicle with its rider 250 Kg-m2 ; moment of inertia of the engine flywheel 0.3 Kg-m2 ; moment of inertias of each road wheels 1 Kg-m2 ; speed of engine flywheel 5 times that of road wheels and in the same direction ; height of the centre of gravity of the rider with vehicle 0.6 m ; two wheeler speed 90 Km/h ; wheel radius 300 mm ; radius of the turn 50m

JAGANNATH UNIVERSITY

Question bank

SUB: I.C.Engine(ME505)

Unit-1

1 Explain working of four stroke petrol engine with neat diagram.

2 Discuss the differences between four stroke and two stroke engines.

3 Explain with suitable sketches the working of four stroke C.I. engine.

4 Discuss the differences between spark ignition and compression ignition engines.

5 Obtain an expression for the air standard efficiency of an engine working on the otto cycle.

6 Obtain an expression for the air standard efficiency of an engine working on the diesel cycle.

7 Obtain an expression for the air standard efficiency of an engine working on the dual cycle.

8 Explain the different part of I.C.Engine.

9 The bore and stroke of an engine working on the otto cycle are 17cm and 30 cm respectively. The clearance volume is 0.001025 m3 .Calculate the air standard efficiency.

10 Explain the classification of I.C.Engines.

Unit-2

1 What is the use of fuel –air cycle?

2 Describe the phenomenon of detonation or knocking of SI engines. On what factors does detonation depend?

3 Explain the phenomenon of diesel knock. Compare it with the phenomenon of detonation in SI engine.

4 What is mean by Dissociation.

5 Comparision of air standard and fuel air cycle.

6 What do you understand by delay period and ignition lag period.

7 Explain the theories of detonation.

8 Explain the types of combustion chamber.

9 Discuss the variables affecting the delay period.

10 Explain the stages of combustion in CI engine.

Unit -3

1Explain the simple carburettors with neat diagram.

2 Describe a battery ignition system with the help of a sketch.

3 What are the factors which affect the process of carburetion?

4Explain the CRDI system.

5 Explain the fuel supply in C.I.Engine.

6 What additional systems are necessary in a complete carburetor? Why?

7 Describe the types of injection systems. Why air injection system is not used?

8 What are the factors which must be considered before deciding the firing order.

9 Discuss the requirements of an ideal injection.

10 Compare the battery ignition with magneto ignition system.

Unit-4

1 Discuss the various methods of determining engine friction.

2 What are the supercharging limits for SI engine and CI engine?

3 Discuss the important properties of a lubricant which effect engine performance.

4 What are the two main types of cooling systems? Explain them with diagram.

5 Enlist and discuss the important properties of a lubricants.

6 Discuss the wet sump lubrication system with suitable sketches.

7 Why cooling of an IC engine is necessary.

8 Explain the scavenging process.

9 Explain the valve timing diagram of 4s SI engine.

10 Describe with sketches the different methods of supercharging.

Unit-5

1 What is dual fuel engine? Explain it.

2 How the fuel is measured in an engine test?

3 What is a multi fuel engine? Where this type of engine finds applications.

4 Describe the morse test .What is the assumption made in this test?

5Discuss the performance of multifuel engine on various fuel.

6 Explain the working of rotary engine.

7 What is a stratified charge engine?

8 What are the important methods of charge stratification?

9What do you understand by free piston engines.

10 What are the advantages of free piston engines.

QUESTION BANK

MANUFACTURING TECHNOLOGY (ME 506)

UNIT:-1

Q.1) Define the various tool parts of a single point cutting tool. What are the standards angles of cutting tool? Describe them. What is the difference between standard angles and working angles?

Q.2) What is the difference between orthogonal cutting and oblique cutting?

Q.3) A lathe while running consumes 500W and 2500 W when cutting a steel specimen at 30m/min.Determine the cutting force and torque at the spindle at 120 rpm.Also determine the specific power consumption if the depth of cut is 4mm and feed is 0.25mm/rev.

Q.4) In an orthogonal cutting operation, the following data have been observed:-

Uncut chip thickness, t=0.127mm

Width of cut, b=6.35mm

Cutting speed, V=2m/s

Rake angle $\alpha = 10^{\circ}$

Cutting force $F_c = 567$ N

Thrust force $F_t = 227$N

Chip thickness $t_c = 0.228$mm

Determine: - Shear angle, the friction angle, shear stress along the shear plane and the power for the cutting operation. Also find the chip velocity, shear strain in chip and shear strain rate

Q.5) Prove that the specific cutting pressure in an ideal orthogonal cutting is $2s_c\cot\phi$ if \ $2\phi+\beta-\alpha=90$,

Q.6) Explain the mechanism of chip formation.

Q.7) Write the relations between ASA and ORS of tool angles.

Q.8) Show the ORS of tool angles with the help of a sketch.

Q.9) Show the ASA of tool angles with the help of a sketch.

Q.10) A 300mm diameter bar is turned at 45 rev/min with depth of cut of 2mm and feed of 0.3mm/rev.The forces measured at the cutting tool point are:-

cutting force= 1850N

Feed force=450N

Calculate: - Power consumption, Specific cutting energy, Energy consumed if the total metal removed during the turning operation is $2.5*10^6 mm^3$

UNIT:-2

Q.1) How do you define tool life and tool failure?

Q.2**)** A cutting tool, cutting at 25m/min, gave a life of 1 hour between re-grinds when operating on roughening cuts with mild steel. What will be its probable life when engaged on light finishing cuts? (Take n= 1/8 for roughening and 1/10 for finishing cuts in the Taylor's equation $VT^n = C$)

Q.3**)** Explain selection of Cutting fluid.

Q.4) What is meant by 3-2-1 principle of location? Explain.

Q.5) Discuss the variables affecting tool life.

Q.6) Derive an expression for optimum value of cutting speed.

Q.7) Describe how the designs for jigs and fixtures are planned?

Q.8) what are the important principles of jig Design?

Q.9) what are the essential characteristics in the proper design of jigs and fixtures?

Q.10) How to determine that the jigs and fixtures for a particular application will be economical?

UNIT:-3

Q.1) What are the various factors to be considered in selection of grinding wheel? Discuss each in detail.

Q.2) Which types of machines used for Surface grinding? Explain.

Q.3**)** Short notes on:-

1) Honing 2) Lapping 3) Super finishing.

Q.4) which types of machines used for cylindrical grinding? Explain.

Q.5) Short notes on:-

Super finishing, polishing and buffing processes.

Q.6) Grinding wheel characteristics or the performance of a grinding wheel depends on type of abrasive ,grain size, grade, structure, and bonding material. Discuss the effect of each.

Q.7) Select a proper grinding wheel for cylindrical grinding of cast iron workpiece.Fine finishing is desired.

Q.8) Describe the various types and kind of abrasives.

Q.9) How do work speeds affect finish in cylindrical grinding?

Q.10) Select a proper grinding wheel for finish grinding HSS with a 150mm diameter straight wheel on a surface grinder using no coolant.

UNIT:-4

Q.1) What are the advantages and limitations of thread rolling?

Q.2) Explain gear generation processes by gear hobbling and gear shaping.

Q.3) Write short notes on:-

1) Gear Grinding 2) Gear Lapping 3) Shot Blasting.

Q.4) How are threads cut on a turret lathe?

Q.5) What are the factors governing the speed of tapping?

Q.6) Describe the operation of planetary type thread milling machine.

Q.7) For what types of jobs you will prefer hobbing operation for generating gear.

Q.8) A pair of bevel gear is designed whose axes are at 90°. The pinion has 40 teeth and the gear has 80 teeth with a module of 1.5mm.Determine the dimensions of the various principal parts and describe the various steps to manufacture it.

Q.9) Discuss the various gear finishing operations.

Q.10) Write about the following methods of gear manufacture:- extrusion, cold drawing,

stamping and power and metallurgy.

UNIT:-5

Q.1) Give a schematic diagram of laser beam machining. Explain the interaction of laser beam with work piece. What are the critical parameters and limitations of laser beam machining?

Q.2) Give a schematic diagram of Electric discharge machining and explain its working.

Q.3) Give a schematic diagram of USM and explain its working.

Q.4**)** Give a schematic diagram of EBM and explain its working.

Q.5) Give a schematic diagram of AJM and explain its working.

Q.6) Give a schematic diagram of PAM and explain its working.

Q.7) Give a schematic diagram of High velocity forming of metals and explain its working.

Q.8) Explain Explosive forming and its working.

Q.9**)** what is the principle of hydro-spark forming?

Q.10) what is the theory behind expansion magnetic forming? State a few application of this process?.

JAGANNATH UNIVERSITY,JAIPUR

QUESTION BANK,VI SEMESTER (MECHANICAL)

SUBJECT:-REFRIGERATION & AIR CONDITIONING (ME 601)

UNIT 1

Q1. What do you understand by refrigeration? what is the unit of refrigeration.

Q2..Explain the difference between heat pump and refrigerator and also prove

$COP_{HP}=1+COP_{REF}$.

Q3. Explain reversed Carnot cycle with neat diagram.

Q4. Explain reversed Brayton cycle with neat diagram.

Q5. Explain Bell- Coleman cycle with neat diagram

Q6. Explain vapour compression refrigeration cycle with neat diagram. Draw P-H and T-S diagram also.

Q7. Explain the actual vapour compression refrigeration cycle with neat diagram.

Q8. In a refrigerator working on Bell-Coleman cycle, the air is drawn into the cylinder of the compressor from the cold chamber at a pressure of 1.03 bar and temperature 12^0C . After isentropic compression to 5.5 bar, the air is cooled at constant pressure to a temperature of 22^0C. The polytropic expansion $pv^{1.25}$=C, then follows and the air expanded to 1.03 bar is passed to cold chamber. (Y= 1.4, Cp= 1.003kj/kgk)Determine:

(i) work done

(ii) C.O.P.

Q9. In a refrigerator working on Bell-Coleman cycle, the air is drawn into the cylinder of the compressor from the cold chamber at a pressure of 1 bar and temperature 05^0C. After isentropic compression to 5 bar, the air is cooled at constant pressure to a temperature of 25^0C. The polytropic expansion $pv^{1.2}$=C, then follows and the air expanded to 1bar is passed to cold chamber. (γ= 1.4, Cp= 1kJ/kgK)Determine: work done.

Q10 A Vapour compression refrigerator works between the pressure limits of 60 bar and 25 bar. The working fluid is just dry at the end of compression and there is no under cooling of he fluid before the expansion. Determine the C.O.P of the cycle and capacity of refrigerator if the fluid flow rate of 5 kg/min.

Pressure(bar)	Temperature(K)	Enthalpy(kj/kg)		Entropy(kj/kgk)	
		Liquid	Vapour	Liquid	Vapour
60	295	151.96	293.29	0.554	1.0332
25	261	56.32	322.58	0.226	1.2464

UNIT 2

Q11.A refrigeration machine requires to produce ice at 0 C from water at 20 C. The machine has a condenser temperature of 298 K while the evaporator temperature is 268 K. The relative efficiency of the machine is 50% and 6 kg of Freon-12 refrigerant is circulated through the system per minute. The refrigerant enters the compressor with the dryness fraction of 0.6 specific heat of water is 4.187 KJ/Kg K and the latent heat of ice is 335 KJ/Kg. Calculate the amount of ice produced in 24 hours. The table of properties of Freon-12 is given below

Temperature (K)	Liquid Heat (KJ/Kg)	Latent Heat (KJ/Kg)	Entropy Of Liquid (KJ/Kg K)
298	59.7	138.0	0.2232
268	31.4	154.0	0.1251

Q12.A simple air cooled system is used for an aeroplane having a load of 10 tonnes. The atmospheric pressure and temperature are 0.9 bar and 10^0C respectively. The pressure increase to 1.013 bar due to ramming. The temperature of the air is reduced by 50^0C in the heat exchanger. The pressure in the cabin is 1.01 bar and the temperature of air leavingthe cabin is 25^0C. Determine power required and C.O.P of system. Assume expansion and compression are isentropic. The pressure of compressed air is 3.5 bar.

Q13. In an aircraft a bootstrap refrigeration system is used to take 18 tonnes of refrigeration load. The ambient conditions are -50^0C and .225 bars. The pressure ratio of the main compressor is 3.5 and required air for refrigeration is bled-off from the main compressor. The air taken from the main compressor is further compressed in secondary compressor which is run by cooling air turbine. The output of the cooling air turbine is just sufficient to run the secondary turbine. The refrigerating air coming out from secondary compressor is cooled by ram air to 50^0C. The air pressure coming out of cooling turbine and supplied to the cabin is 1 bar. The temperature maintained in the cabin is 25^0C.

$\eta ram=\eta c1=\eta c2=90\%$, $\eta t=80\%$,

When aircraft is moving with a speed of 1000km/h, determine:

(i) Delivery pressure of secondary compressure, (ii) COP

Q14. Explain the bootstrap regenerative cycle with neat diagram.

Q15. Q. Find the C.O.P for a refrigerator working between the temperature range of 25^0 C and -5^0C. The dryness fraction during the suction stroke is 0.6. Following properties are given:

Temperature(K)	Enthalpy(kj/kg)		Entropy(kj/kg)		Latent heat(kj/kg)
	Liquid	Vapour	Liquid	Vapour	
298	164.77	282.23	0.5978	0.9918	117.46
268	72.57	321.33	0.2862	1.2146	248.76

Q16. Explain the working of simple air cycle cooling system used for aircrafts.

Q17. A refrigeration machine requires to produce ice at 0 C from water at 20 C. The machine has a condenser temperature of 298 K while the evaporator temperature is 268 K. The relative efficiency of the machine is 50% and 6 kg of Freon-12 refrigerant is circulated through the system per minute. The refrigerant enters the compressor with the dryness fraction of 0.6 specific heat of water is 4.187 KJ/Kg K and the latent heat of ice is 335 KJ/Kg. Calculate the amount of ice produced in 24 hours. The table of properties of Freon-12 is given below

Temperature (K)	Liquid Heat (KJ/Kg)	Latent Heat (KJ/Kg)	Entropy Of Liquid (KJ/Kg K)
298	59.7	138.0	0.2232
268	31.4	154.0	0.1251

Q18. Explain the cascade system with neat diagram.

Q 19. State merits and demerits of an air refrigeration system.

Q 20. Explain the different types of compressor

UNIT 3

Q21. State the advantages of vapour absorption refrigeration system over vapour compression system.

Q22. Explain the Electrolux refrigeration absorption system with neat diagram.

Q23. Enumerate the desirable properties of an ideal refrigerant.

Q24. Explain the Lithium Bromide absorption system with neat diagram.

Q25. How are refrigerants designated?

Q26. Name three refrigerants that are commonly used in commercial refrigerators. Discuss their relative merits and demerits.

Q27. What is a secondary refrigerant? Where is it used?

Q28. Give the main types of condensers in use with specific application of each type.

Q29. Explain the different types of evaporators.

Q30. Explain briefly about the thermostatic valve and capillary tube.

UNIT 4

Q.31What is an effective temperature? Explain briefly Effective temperature chart and comfort chart.

Q32. Air at 12^0C DBT and 70%RH is to be heated and humidified to 36.5^0C DBT and 21^0C WBT. The air is preheated sensibly before passing to the washer in which water is circulated. The relative humidity of the air coming out of the air washer is 70%.This air is again reheated sensibly to obtain the final desired condition. Determine:

(i) Total heating required
(ii) Make up water required in the air washer.

Q33. 120m^3 of air per minute at 35^{0}C DBT and 50% RH is cooled to 20^{0}C DBT by passing through a cooling coil. Determine the following

(i) WBT and RH of out coming air

(ii) Capacity of cooling coil in tones.

Q34. Describe briefly the following processes:

(i) Cooling and dehumidification (ii) Heating and humidification
(ii) Heating and dehumidification

Q35. Write a short note on by pass factor.

Q36. State and explain factors which govern optimum effective temperature.

Q37. How are air conditioning systems classified?

Q38.What is effective room sensible heat factor?

Q39. Explain briefly air washers and radiators.

UNIT 5

Q40. Write a short note on thermodynamics of a human body.

Q41 State the advantages of central system over unitary system of air conditioning.

Q42 Explain the difference between summer air conditioning and winter air conditioning.

Q43 Enumerate and explain the components of cooling load estimate.

Q44 What is the function of a filter? How are filters classified?

Q45. It is required to design a cold storage for storing 450 tonnes of vegetables with the following available data:

Inside design conditions…….19^{o}C DBT,60% RH

Outdoor conditions ……36^o C DBT, 28^O C WBT

Infiltrated air …….180 m^3 /h

Fresh air supplied from outside……..4500 m^3 /h

No. of persons working in the cold storage … ……20

Sensible heat gain through glass…….5.5 k w

Sensible heat gain through walls and ceilings……10.8 k w

Water contents of vegetables…….74%

Loss Water contents……..0.01 per cent per hour

Heat from equipment and reaction heat of vegetables …….3.1 kw

If the air –conditioning is achieved by first cooling and dehumidifying and then heating . and the temperature of air entering the room is not to exceed 16^{o} C, determine.

(i) Amount of re circulated air, if the re circulated air is mixed with fresh air before entering the cooling coil ;
(ii) Capacity of the cooling coil in tonnes of refrigeration and its by-pass factor if dew point temperature of the heating coil in kw
(iii) Capacity of the heating coil in kw

Q46. The following data is available for designing an air –conditioning system for a restaurant:

Inside design conditions…….26^{o}C dDBT,60% RH

Outdoor conditions ……..…36^{o} C DBT, 27^{O} C WBT

Minimum temperature of air supplied……..1550 m^3 /h

Total infiltrationair……..390 m^3 /h

Seating chairs for dining……45

Employees serving the meals……..5

Sensible heat gain per person----------60kw

Latent heat gain per sitting person----------45kw

Latent heat gain per employee----------75kw

Sensible heat added from meal----------0.16kw

Sensible heat added from meal----------0.16kw

Latent heat added from meal----------0.28kw

Total heat flow through walls, roof and floor----------5.9kw

Solar heat gain through glass----------1.9kw

Equipment sensible heat gain----------2.75kw

Equipment latent heat gain----------0.65kw

Motor power connected to fan----------7.5kw

If the fan is installed before the conditioner, determine:

(i) Amount of air delivered
(ii) Percentage of recirculated air
(iii) Load on coil in tonnes
(iv) DPT and by-pass factor

Q47 Air flowing at the rate of 100m^3/min at 40^{0}C DBT and 50% RH is mixed with another stream at the rate of 20m^3/min at 26o C DBT and 50% RH . The mixture flows over a cooling coil whose ADP temperature is 10^{0} C and bypass factor is 0.2. Find DBT and RH of air coil.

Q48 Air flowing at the rate of 100m^3/min at 30^{0}C DBT and 60% RH is mixed with another stream at the rate of 20m^3/min at 20^{o} C DBT and 60% RH . The mixture flows over a cooling coil whose ADP temperature is 10^{0} C and bypass factor is 0.2. Find DBT and RH of air coil. If this air is supplied to an air conditioned room where DBT of

26^0 and RH of 60% are maintained, estimate room sensible heat factor and cooling load capacity of the coil in tonnes .

Q 49 The A.C. plant supplies a total of 4500 m^3/ min of dry air which comprises by weight 20% fresh air at 40^0C DBT and 27^0 C WBT and 80% re circulated air at 25^0 C DBT and 50% RH. The air leaves the cooling coil at 13^0 C saturated states. Calculate cooling and room heat gain.

Q50 Describe briefly with neat sketch a window type air conditioner.

JAGANNATH UNIVERSITY,JAIPUR

QUESTION BANK

SUBJECT:-INDUSTRIAL ENGINEERING (ME 602)

UNIT 1

Q.1 Discuss the term Management along with the contribution of different leaders in scientific management

Q.2 Give detailed explanation of management functions

Q.3 Explain following in detail

(a) Evolution of Management

(b) Scientific Management

Q.4 Highlights the merits and demerits of different contributors in scientific Management.

Q.5 Draw the flow chart to differentiate the level of Management, along with their responsibilities and functions.

Q.6 Prepare a case study based on functions of Management

Q.7 Management plays a lead role in enhancing the organization structure, Justify this statement with example.

Q.8 Classify the level of Management with group of employees, also showing their Responsibilities.

UNIT 2

Q.1 Define the term production and explain the type of production with their application

Q.2 Explain the function of production, planning & control in detail.

Q.3 Explain following in detail

(a) Short term & Long term forecasting

(b) Planning Phases

Q.4 Justify the interdependency of forecasting and inventory cost with suitable example.

Q.5 Prepare a Routing and scheduling chart of any production process with time and Sequence.

Q.6 Discuss the term forecasting and discuss the supplication of short term forecasting and long term forecasting.

Q.7 Discuss the preplanning and planning phase utility and focus how, they are

beneficial in running the production in right direction.

Q.8 Discuss the term routing and scheduling, also draw a layout with the group of machine to show routing and scheduling.

UNIT 3

Q.1 Define the role of financial management and differentiate between the fixed asset and current assets also discuss the following ratio.

(a) Liquidity Ratio
(b) Inventory Ratio
(c) Current Ratio

Q.2 What is meant by Depreciation and discuss the causes & types of the same , also solve following numerical problem. A photocopy machine has been purchased for Rs 45000 and its useful life is estimated to be 10 years. Its scrap value at the end of 10 years is 14,000. If the depreciation is charged by Diminishing balance method, then calculate.

(a) The % by which the value of machine is reducing every year.

(b) Depreciation in first two years and last two years of machine life.

Q.3 Write down short notes on following

(a) Kinds of capital

(b) Sources of capital

Q.4 Why we need of Depreciation calculation and also discuss in detail, the types and causes of depreciation.

Q.5 Define the term Depreciation and write down various methods which are used in calculation of depreciation.

Q.6 Write down short notes on following

(a) Difference between fixed capital and working capital

(b) Need of finance

Q.7 A computer has been purchased for Rs 60000/- and its useful life is estimated to be 10 yrs. Its scrap value at the end of 10 yrs. is 12000/- If the depreciation is charged by diminishing balance method calculate.

(a) The % by which the value of computer is reducing every year.

(b) Depreciation in first two yrs and last two years of computer life.

Q.8 (a) A lathe machine has been purchased for Rs 65000 and its estimated useful life is 5 years .Calculate the depreciation at the end of each yr by sum of years digit method , its scrap value is 5000

(b) Define Depreciation and discuss its causes in details

Q.9 (a) A furnace was purchased for Rs 50,000 and Rs 5000 spent on its erection and

commissioning. The estimated salvage value after 10 years was Rs . 5000 Calculate

(1) Annual rate of depreciation

(2) Determine the depreciation fund collected at the end of six years after the purchase of the Furnace

(b) Write down various methods which are used in calculation of depreciation

UNIT 4

Q.1 List out the factors which are considered in selection of plant location and explain them in detail.

Q.2 Classify the production layout ,sketch the each layout with example.

Q.3 Define the term material management and focus its objectives in context to

Productivity enhancement.

Q.4 How ABC analysis is supportive in reducing inventory cost of an organization.

Q.5 Give detailed classification of material handling equipments with their function and sketches.

Q.6 Prepare a case study, emphasizing on material handling equipments to reduce overall cycle time.

Q.7 Explain product layout, process layout and fixed layout with their application and also draw their layout.

Q.8 Write down short notes on following

(a) ABC analysis

(b) Material handling equipment

UNIT 5

Q.1 Discuss the methods of settling disputes in detail

Q.2 Write down short notes on following

(a) Trade unions

(b) The factory Acts

Q.3 Classify the wage incentive schemes with their application and example.

Q.4 What are the characteristics of good wage or incentive system.

Q.5 Write down short notes on following

(a) Financial and non financial incentive schemes.

(b) The factory Acts

Q.6 Write down the methods of wage payment with their examples and characteristics.

Q.7 Classify the Trade unions with their features and also focus the role of Trade unions in solving industrial disputes.

Q.8 (a) Differentiate between time based and output based wage incentive plans

(b) Standard time (S) =10 hrs, Time taken (T) =8 hrs, Rate of wages (R) = Rs 20 per hr

Bonus (P) = 50%, Calculate total wages by Rowan plan and Halsey plan.

Q.9 (a) Standard time (S) = 240 Rs (4 hrs), Actual Time taken (T) =180 Rs (3 hrs),

Rate of wages (R) = Rs 0.50 per B, Calculate total wages.

(b) Standard time (S) =10 hrs, Time taken (T) =8 hrs, Rate of wages (R) = Rs 20 per hr

Bonus = 10% up to 75% efficiency

= 20% for 75% - 100%

= 30 % beyond 100% Calculate Total wages

JAGANNATH UNIVERSITY

QUESTION BANK

CAD-CAM (ME 603)

Unit-1

Q1. Define CAD. Explain the reasons for adopting CAD in an engineering organisation.

Q2. Explain the importance of engineering analysis in the design cycle.

Q3. Explain with an example various steps in the modern design process.

Q4. Explain the following steps in the design process:

(a). Problem Definition (b). Engineering Analysis

Q5. Define CAM. Write down the advantages gained by the adoption of CAM.

Q6. Briefly explain the computerised product cycle in the manufacturing environment.

Q7. Specify the various stages present in a conventional design process.

Q8. Explain the role of engineering analysis process in the product design cycle.

Q9. What do you understand by CIM lean manufacturing?

Q10. Write about the prototype development as part of the design process.

Unit-2

Q1. Compare 2D and 3D wireframe modelling with respect to their utility for an engineering industry.

Q2. Classify the various geometric modelling systems based on their capabilities.

Q3. Explain different types of geometric modelling methods used in CAD.

Q4. What are the limitations in utilising the sweep method for geometric construction?

Q5. What is the best kind of modelling system? Explain with suitable sketches.

Q6. Give the reasons for the importance of 3D geometry in modern CAD systems.

Q7. Explain the different types of database organisation methods used in 3D CAD systems.

Q8. What are the limitations in utilising the sweep method for geometric construction?

Q9. What are the limitations found in the general wireframe model?

Q10. Specify the three principal classifications of the geometric modelling systems and write in brief about each of them.

Unit-3

Q1. What are the difference between NC and CNC?

Q2. Explain the advantages to be gained by using CNC compared to NC.

Q3. What are the types of NC machines? Explain in detail.

Q4. How does a tool change occur in a typical automatic tool changer?

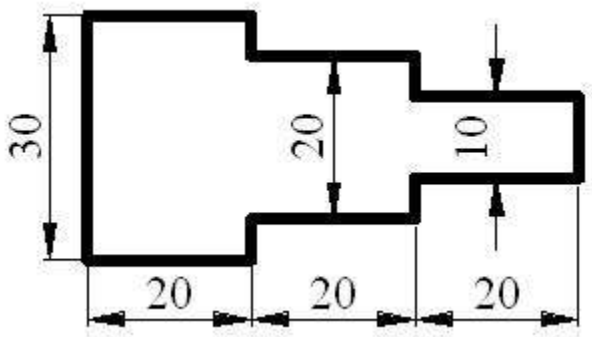
Q5. Give brief description of CNC turning centres.

Q6.What are the various sub-systems present in a modern CNC controller unit?

Q7. What is adaptive control optimisation? How is it used in CNC machines?

Q8. How do you distinguish between high speed machining and conventional machining?

Q9. Write the part programme for the given diagram.



Q10. What are the most important functions that are used for programming?

Unit-4

Q1. Give the details of any one advanced function that facilitates the CNC part programming.

Q2. What are the major components present in an automated storage and retrieval system?

Q3. What are the methods used for programming a robot?

Q4. What are the various types of material handling systems used in FMS?

Q5. Explain briefly about production flexibility and routing flexibility in FMS.

Q6. What are the various types of layouts used in FMS design?

Q7. What is probe in CMM? Explain how does it work?

Q8. What are the advantages of CMM?

Q9. Explain briefly the function of SQC.

Q10. Explain briefly about non-contact CMM.

Unit-5

Q1. Define computer integrated manufacturing.

Q2. Describe the factors responsible for the success of CIM applications in the present time.

Q3. Explain the SME manufacturing enterprise wheel.

Q4. Explain with an example how the integration benefits any manufacturing operation.

Q5. Explain the aspects that one should consider in implementing CIM.

Q6. What do you understand by the term lean manufacturing?

Q7. Explain the steps used in implementing lean manufacturing.

Q8. Briefly explain TQM.

Q9. Briefly explain coordinate measuring machine.

Q10. Explain the six sigma process.

JAGANNATH UNIVERSITY,JAIPUR

QUESTION BANK

SUBJECT:- FUNDAMENTALS OF AERODYNAMICS (ME 604)

UNIT-1

Q.1 What do you understand by circulation? Discuss in detail about Kelvin circulation theorem. Also show the interrelation.

Q.2 What is lift and drag? Derive an expression for formula of lift and drag in terms of normal and axial forces acting on a plane.

Q.3 Discuss aerodynamic moment acting on the aero plane and drive a relation of aerodynamic moment in terms of pressure and shear stress acting on the upper and lower surface of the plane.

Q.4 Define and explain centre of pressure for an airfoil with a neat diagram. Also indicate the relation between centre of pressure and lift.

Q.5 What is an airfoil? Explain various terms associated with airfoil nomenclature indicating them on an airfoil sketch.

Q.6 An airfoil of chord length 2m and span 12m has an angle of attack as 6°. The airfoil is moving with a velocity of 70 m/s in air whose density is 1.20 kg/m3. Find the weight of airfoil and the power required to drive it. The values

The effective jet exit velocity from a jet engine is 2700 m/s. The forward flight velocity is 1350 m/s and air flow rate is 78.6 kg/s calculate

of co-efficient of drag and lift corresponding to angle of attack are given as 0.03 and 0.5 respectively.

Q.7 Explain the Kutta condition. What is the Kutta condition in terms of strength of vortex sheet?

Q.8 What do you understand by symmetrical and non symmetrical aerofoil? Derive an expression for lift and moment of symmetrical aerofoil.

Q.9 Write short notes on:

i. Lift and drag coefficient

ii. Angle of attack

iii. Chord length

iv. Centre of pressure

v. Aspect Ratio

Q.10 A wing of an aircraft of 10m span and 2m mean chord is designed to develop a lift of 45 KN at a speed of 400 km/h. A 1/20 scale model of the wing section is tested in a wind tunnel at 50 m/s and T =5.33 kg/m3. The total drag measured is 400 N. Assuming that the wind tunnel data refer to a section of infinite span, calculate the total tunnel data for full size wing. Assume an elliptical lift distribution and take air density as 1.2 kg/m3.

UNIT-2

Q1. What is propulsion? Explain its various types.

Q2. Explain Closed cycle gas turbine with regeneration and inter cooling.

Q3. Explain Ramjet engine and its cycle

Q4. What is pulse jet engine? Explain its cycle and performance characteristics

Q5. What is thrust? Derive its equation.

- Thrust
- Thrust power
- Propulsive efficiency

Q6. What is turbojet engine? Derive its expression for thermal efficiency.

Q7. Write short notes on

- Reheating
- Brayton Cycle

Q8. Explain the various types of propellers and their importance with figures

Q9. Draw and explain the characteristics curves of a gas turbine cycle and define the ratios involved.

UNIT-3

Q.1 Define isentropic flow and derives the expression for steady isentropic flow in non-parallel side ducts neglecting friction.

Q.2 What do you mean by choked flow? Discuss about the flow through convergent-divergent nozzle.

Q.3 Air enters isentropic diffusers with a mach number of 3.6 and decelerated to a mach number of 2. The diffuser passes a flow is 1.5 kg/s. The initial static pressure and temperature of the air are 1.05 bar and 40°C. Assuming γ=1.4. Calculate area, total pressure and total temperature at inlet and exit and static temperature and pressure at exit.

Q.4 Derive the following relations for isentropic flow

i. $\frac{dP}{\rho} = [\frac{M^2}{1-M^2}]\frac{dA}{A}$

ii. $\frac{dV}{V} = -[\frac{1}{1-M^2}]\frac{dA}{A}$

Q.5 Show that the mass flow through a choked nozzle is

$$m^* = \frac{P_o A^*}{\sqrt{T_o}}\sqrt{\frac{\gamma}{R}}(\frac{2}{\gamma+1})^{\frac{(\gamma+1)}{(\gamma-1)}}$$

Q.6 a) Establish relation between first kind of Mach number(M) and second kind of Mach number (M*).

b) For an isentropic flow, prove that

$$\frac{dA}{A} = \frac{dp}{\rho C^2}(1 - M^2)$$

Where A=area, p= pressure, ρ=density, C=velocity of flow, M=Mach number

Q.7 Air is discharged from a reservoir at $p_o = 6.91$ bar and $t_o = 325°C$ through a nozzle to an exit pressure of 0.98 bar. If the flow rate is 3600 kg/hr, determine for isentropic flow:

a) Throat area, pressure and velocity

b) Exit area, Mach number

c) Maximum velocity.

Q.8 a)Derive an expression for velocity of sound and prove that **a**=$\sqrt{\gamma RT}$

b) Prove the area ratio for an isentropic flow in terms of Mach number and prove that

$$\frac{A}{A^*} = \frac{1}{M}[\frac{2}{\gamma+1} + \frac{\gamma-1}{\gamma+1}M^2]^{\frac{(\gamma+1)}{2(\gamma-1)}}$$

Q.9 Write short notes on:

i. Mach angle

ii. Mach number

iii. Mach cone

iv. Types of flow

v. Stagnation velocity of sound

Q.10 In an airflow where the local mach number, static pressure and static temperature are 3.5, 0.3 atm and 180k respectively. Calculate the local values of $P_o, T_o, T^*, a^* \; and \; M^*$ at this point.

UNIT-4

Q.1 Prove that the Dimensionless value of the heat transfer in a Rayleigh process from a mach number M1 to M2 is

$$\frac{Q}{C_p T_1} = \frac{M_2^2 - M_1^2}{2M_1^2(1+\gamma M_2^{2)2}}[2(1-\gamma M_1^2 M_2^2)+(\gamma - 1)(M_2^2+M_1^2)]$$

Q.2 a) List out the differences between adiabatic flow and diabatic flow with practical examples for each.

b) Explain the flow with heat transfer and also explain the effect of change in stagnation temperature.

Q.3 Define Fanno flow. Explain Fanno flow on h-s plane and prove that velocity is sonic at maximum entropy. Also prove an expression for pressure and temperature ratio.

Q.4 Air at pressure $P_o = 10\ bar, T_o = 400K,$ is supplied to 50mm diameter pipe. The friction factor for the pipe surface is 0.002. If the mach number changes from 3.0 at the entry to 1.0 at the exit, determine the length of the pipe?

Q.5 Explain Rayleigh flow and Rayleigh curve.

Q.6 In a Rayleigh flow, if value of mach number at exit is 0.93, stagnation temperature is 300°C and at inlet stagnation temperature is 100°C, find the mach number at inlet and ratio of exit pressure and inlet pressure. ($\gamma = 1.4$)

Q.7 For a fanno flow prove that

$$\frac{S_2 - S_1}{R} = ln\frac{M_2}{M_1}\left[\frac{1+\frac{\gamma-1}{2}M_1^2}{1+\frac{\gamma-1}{2}M_2^2}\right]^{\frac{\gamma+1}{2(\gamma-1)}}$$

Q.8Prove that temperature ratio for Rayleigh functions is

$$\frac{T_2}{T_1} = \frac{M_2^2}{M_1^2}\frac{(1+\gamma M_1^2)^2}{(1+\gamma M_2^2)^2}$$

Q.9 Prove an expression for pressure ratio for Rayleigh flow.

Q.10 Air enters an insulated tube 25mm diameter through a convergent- divergent nozzle with a throat diameter of 10 mm. The pressure and temperature in the low velocity region at nozzle entrance are 700 kpa and 333K respectively. Assume frictionless flow. Calculate maximum length of duct. Take $\gamma = 0.002$

UNIT-5

Q.1 What do you mean by shock waves? Explain the different types of shock waves graphically.

Q.2 Derive an equation for Rankine- Hugoniot relation for normal shock.

Q.3 Derive Prandtl-Mayer relation.

Q.4 Show that change in entropy across a normal shock are given by:

$$\Delta S = R \ln \left(\frac{P_{ox}}{P_{oy}}\right)$$

Q.5 Discuss about the plane stationary normal shock.

Q.6 Derive the equation for static pressure ratio across the normal shock.

Q.7 Air has a temperature and pressure of 300 °K and 2 bars absolute respectively. It is flowing with a velocity of 868m/s and enters a normal shock. Determine the density before and after the shock. [$\gamma = 1.4$]

Q.8 Derive the following relationship for a normal shock wave-

$$C_x C_y = (a^*)^2$$

Where $C_x = velocity\ before\ shock,\ C_y = velocity\ after\ shock$

a^*= critical velocity of sound

JAGANNATH UNIVERSITY,JAIPUR

QUESTION BANK,

SUBJECT:- OPERATION RESEARCH (ME 605)

UNIT 1

1. What is OR? Give some applications.
2. What do you mean by general LPP?
3. Write any two situations where LPP is applied.
4. Graphical solution is not possible for LPP problem with more than two constraints
   True or False? Justify your answer

5. What is the use of artificial variable in LPP
6. Define Slack, Surplus variables
   What do you mean by degenerate solution in LPP

   Define a feasible region in graphical method.

7. What is meant by an optimal solution?
   What is the difference between feasible solution and basic feasible solution?

8. Define non-degenerate solution
9. Define unbalanced solution and infeasible solution
10. A firm produces 3 products. These products are processed on 3 different machines. The time required manufacturing one unit of each of the 3 products and the daily capacity of the 3 machines are given below:

Machine	Time per unit (minutes)			Machine Capacity (Minutes/day)
	Product1	Product2	Product3	
M_1	2	3	2	440
M_2	4	-	3	470

M_3	2	5	-	430

It is required to determine the number of units to be manufactured for each product daily. The profit per unit for product 1,2 and 3 is Rs4, Rs3, Rs6 respectively. It is assumed that all the amounts produced are consumed in the market. Formulate the mathematical model for the problem.

UNIT 2

Question (11)

A firm produces an alloy having the following specifications:

(i) Specific gravity ≤ 0.98

(ii) Chromium ≥ 8%

(iii) Melting point ≥ 450°C

Raw materials A, B, C having the properties shown in the table can be used to make the alloy.

Property	Raw material		
	A	B	C
Specific gravity	0.92	0.97	1.04
Chromium	7%	13%	16%
Melting point	440°C	490°C	480°C

Cost of the various raw materials per unit ton are: Rs.90 for A, Rs.280 for B and Rs.40 for C. Find the proportions in which A,B and C be used to obtain an alloy of desired properties while the cost of raw materials is minimum.

Question (12)

Solve by Simplex Method: Maximize $Z = 3x_1 + 9x_2$

sub to $x_1 + 4x_2 \leq 8$

$x_1 + 2x_2 \leq 4$ & $x_1, x_2 \geq 0$

Question (13)

Solve by Simplex Method : Maximize $Z = 2x_1 + 4x_2$

sub to $x_1 + 2x_2 \leq 5$

$x_1 + x_2 \leq 4$ & $x_1, x_2 \geq 0$

Solve by Simplex Method : Maximize $Z = 2x_1 + x_2$

sub to $x_1 - x_2 \leq 10$

$2x_1 \leq 40$ & $x_1, x_2 \geq 0$.

Question (14)

Solve by Simplex Method : Minimize $Z = 8x_1 - 2x_2$

Sub to $-4x_1 + 2x_2 \leq 1$

$5x_1 - 4x_2 \leq 3$ & $x_1, x_2 \geq 0$

Question (15)

Use Big-M OR Penalty Method to solve

Maximize $Z = 2x_1 + x_2 + x_3$

Sub to $4x_1 + 6x_2 + 3x_3 \leq 8$

$3x_1 - 6x_2 - 4x_3 \leq 1$

$2x_1 + 3x_2 - 5x_3 \geq 4$. & $x_1, x_2, x_3 \geq 0$.

Use Big-M OR Penalty Method to solve

Minimize $Z = 4x_1 + 3x_2$

Sub to $2x_1 + x_2 \geq 10$

$-3x_1 + 2x_2 \leq 6$

$x_1 + x_2 \geq 6$ & $x_1, x_2 \geq 0$.

Question (16)

Use Two-phase method to solve

Maximize $Z = 5x_1 + 8x_2$

Sub to

$3x_1 + 2x_2 \geq 3$

$x_1 + 4x_2 \geq 4$

$x_1 + x_2 \leq 5$ & $x_1, x_2 \geq 0$.

Use Two-phase method to solve

Minimize $Z = -2x_1 - x_2$

Sub to

$X_1 + x_2 \geq 2$

$X_1 + x_2 \leq 4$ & $x_1, x_2 \geq 0$.

Question (17)

Solve by Dual Simplex Method:

Minimize $Z = 3x_1 + x_2$

Sub to

$3x_1 + x_2 \geq 3$

$4x_1 + 3x_2 \geq 6$

$x_1 + x_2 \leq 3$ & $x_1, x_2 \geq 0$.

Solve by Dual Simplex Method:

Minimize $Z = 2x_1 + 3x_2$

Sub to

$2x_1 + 2x_2 \leq 30$

$x_1 + 2x_2 \geq 10$ & $x_1, x_2 \geq 0$.

Question (18)

Write down the dual of the following LPP and solve it.

Max $Z = 4x_1 + 2x_2$

Sub to

$-x_1 - x_2 \leq -3$

$-x_1 + x_2 \geq -2$ & $x_1, x_2 \geq 0$.

Use duality to solve the following LPP

Minimize $Z = 2x_1 + 2x_2$

Sub to

$2x_1 + 4x_2 \geq 1$

$-x_1 - 2x_2 \leq -1$

$2x_1 + x_2 \geq 1$ & $x_1, x_2 \geq 0$.

19 . What do you understand by Transportation problem?

Write the mathematical form of Transportation Problem.

20. What is an unbalanced transportation problem? How to solve it?

UNIT 3

21. Define (i) Feasible solution (ii) Basic feasible solution (iii) Non-degenerate solution

22. What do you understand by degeneracy in a transportation problem

23. When does a TP have a unique solution?

24. What is the purpose of MODI method?

25. List any three approaches used with TP for determining the starting solution (or) the initial basic feasible solution.(i)North – West corner rule (ii) least cost entry method (iii) Vogel's approximations method

Question (26)

Obtain the initial solution for the following TP using NWCR, LCM, VAM

	Destination			
	A	B	C	Supply
1	2	7	4	5
2	3	3	1	8
3	5	4	7	7
4	1	6	2	14
Source Demand	7	9	18	34

Find the optimal solution by using VAM.

Fact ory	Warehouse

		A	B	C	D	E	F	Available
	1	9	12	9	6	9	10	5
	2	7	3	7	7	5	5	6
	3	6	5	9	11	3	11	2
	4	6	8	11	2	2	10	9
	Requirement	4	4	6	2	4	2	

Question (27)

Solve the Assignment problem:

	Men					
		A	B	C	D	E
	I	1	3	2	8	8
	II	2	4	3	1	5
	III	5	6	3	4	6
	IV	3	1	4	2	2
Tasks	V	1	5	6	5	4

Solve the Assignment problem:

	Machine					
		1	2	3	4	5
	A	11	17	8	16	20
	B	9	7	12	6	15
	C	13	16	15	12	16
	D	21	24	17	28	26
Jobs	E	14	10	12	11	15

Question (28)

A company is faced with the problem of assigning 4 machines to different

Jobs (one machine to one job only). The profits are estimated as follows.

Job	Machine				
		A	B	C	D
	1	3	6	2	6
	2	7	1	4	4
	3	3	8	5	8
	4	6	4	3	7
	5	5	2	4	3
	6	5	7	6	4

Solve the problem to maximize the profit.

Question (29)

Determine the optimum assignment schedule for the following assignment

Problem. The cost matrix is given below

Job	Machine						
		1	2	3	4	5	6
	A	11	17	8	16	20	15
	B	9	7	12	6	15	13
	C	13	16	15	12	16	8
	D	21	24	17	28	2	15
	E	14	10	12	11	15	6

If the job C cannot be assigned to machine 6, will the optimum solution change?

Question (30)

A company has four machines to do three jobs. Each job can be assigned to

one and only one machine. The cost of each job on each machine is given in the following table.

	1	2	3	4
A	18	24	28	32
B	8	13	17	19
C	10	15	19	22

What are job assignments which will minimize the cost?

UNIT 4

Question (31)

Write the algorithm for Hungarian method.

There are four machines in a machine shop. On a particular day the shop got

Orders for executing five jobs (A, B, C, D & E). The expected profit for each

job on each job on machine is as follows:

	1	2	3	4
A	32	41	57	18
B	48	54	62	34
C	20	31	81	57
D	71	43	41	47
E	52	29	51	50

Find the optimal assignment of job to machines to maximize the profit. Which

job should be rejected.

32. Define a queue and a customer.

33. What are the basic characteristics of a queuing system?

34. Define (i) Arrival pattern (ii) Service mechanism

35. Define queue discipline

36. Define the following (i) Balking (ii) Reneging (iii) Priorities (iv) Jockeying

Question (37)

Arrivals at the telephone booth are considered to be Poisson with an average time of 12min between one arrival and the next. The length of a phone call is assumed to be distributed exponentially with mean 4min.

(a) Find the average number of persons waiting in the system.
(b) What is the probability that a person arriving at the booth will have to wait in the queue?
(c) Estimate the fraction of the day when the will be in use.
(d) What is the average length of the queue?
(e) What is the average waiting time of the person in system and queue?

Question (38)

Customers arrive at a one-man barber shop according to a Poisson process with a mean inter arrival time of 12min. Customers spend an average of 10min in the barber's chair.

(a) What is the expected number of customers in the barber shop and in the queue?
(b) Calculate the percentage of time an arrival can walk straight into the barber's chair without having to wait.
(c) How much time can a customer expect to spend in the barber's shop?
(d) What is the average time customer spends in the queue?
(e) Calculate the percentage of customers who have to wait prior to getting into barber's chair.

Question (39)

Customers arrive at a watch repair shop according to a Poisson distribution at a rate of one per every 10 minutes and the service time is an exponential random variable with mean 8 minutes. Find Ls, Lq, Ws, Wq.

In a telephone booth the arrivals are on the average 15 per hour. A call on the average takes 3 minutes. If there are just one phone. Find Ls, Lq, Ws, Wq and idle time of the booth.

Customers arrive at a one man barber shop according to a Poisson process with an mean inter arrival time of 12 minutes. Customers spend a average of 10 minutes in the barber's chair. Find Ls, Lq, Ws, Wq.

UNIT 5

Question (40)

Arrivals at a telephone booth are considered to be Poisson with an average time 12 minutes between one arrival and the next. The length of telephone call is assumed to be distributed exponentially with mean 4 minutes.

a) Find the average number of persons waiting in the system.
b) What is the probability that a person arriving at the booth has to wait in the queue?
c) What is the probability that it will take more than 10 minutes for a person to wait and complete his cell?
d) Also estimate the fraction of the day when phone will be in use
e) The telephone department will insult a second booth when convinced that an arrival would expect to wait at least 3 minutes for the phone. By how much should flow of arrivals increase in order to justify a second booth?
f) What is the average length of queue that forms from time to time?

Question (41)

Customers arrive at one man barber shop according to Poisson process with mean interval time of 12 minute. Customer spends an average of 10 minute in the barber chair.

a) What is the expected number of customer in the barber shop and in the queue?
b) Calculate the percentage of time an arrival can walk straight in to the barber chair without having to wait?
c) How much time can customer expect to spend in the barber's shop?
d) Management provides another chair and hires another barber, when customer waiting time in the shop exceeds 1.25 hrs. How much must the average rate of arrivals increase to warrant a second barber?
e) What is the average time customer spends in the queue?
f) What is the probability of waiting time in the system is greater than 30 min?
g) What is the percentage of customer who has to wait prior getting into the barber chair?
h) What is the probability of more than 3 customers in the system?

Question (42)

If people arrive to purchase cinema tickets at the average rate of 6 per minute, it takes an average 7.5 seconds to purchase a ticket. If a person arrives 2 min before the picture starts and if it takes exactly 1.5 min to reach the correct seat after purchasing the ticket.
a) Can he expect to be seated for the start of the picture?
b) What is the probability that he will be seated for the start of the picture?
c) How much must he arrive in order to be 99% sure of being seated for the start of the picture?

Question (43)

An duplicating machine maintained for office use it's operated by an office assistant who earns Rs 5 per hour. The time to complete each job varies according to an exponential distribution with mean 6 minute. Assume Poisson input with an average arrival rate of 5 jobs per hour. If an 8-hour day is used as a base Determine

a) The percentage idle time of the machine?
b) The average time a job is in the system
c) The average earning per day of the assistant?

Question (44)

In the railway marshalling yard goods trains arrive at a rate of 30 trains per day Assume that inter arrival time follows exponential distribution and the service time distribution is also exponential with an average of 36 minutes. Calculate the following

i) Mean queue size
ii) The probability that the queue size is at least 10

iii) If the input of trains increases to an average of 33 trains per day, what will be the change in the above quantities?

Question (45)

Customer arrives at one window drive in bank according to a Poisson process with mean 10 per hour. Service time is an exponential distribution with mean 5 minutes. The space in front of the window including that for a serviced car can accommodate a maximum three cars others can wait outside of the space.
i) What is the probability that an arriving customer can drive directly to the space in front of the window?
ii) What is the probability of arriving customer will have to wait outside of indicated space?
iii) How long is an arriving customer expected to wait before being served?

Question (46)

At what average rate must be a clerk in a supermarket work in order to ensure a probability of 0.90 that the customer will not wait longer than 12 min ? it is assumed that there is only one customer at which customer arrive in a Poisson fashion at an average rate 15 per hour and length of service is an exponential distribution.?

Question (47)

A bank has 2 tellers working on savings accounts. The first teller handles with drawls only. The second teller handles deposits only. It has been found that the service time distribution for both deposits and withdrawals are exponentially distributed with mean service time of 3 minutes per customer. Deposits are found to be arriving at a Poisson fashion throughout the day with mean arrival rate of 16 per hour .withdrawals also arrive in a Poisson fashion with mean arrival rate of 14 per hour. What would be the effect on the average waiting time for the customer if each teller handles both withdrawals and deposits? What would be the effect if this could only be accomplished by increasing the service time to 3.5 minutes?

Question (48)

A supermarket has two girls attending to sales at the counter s. If the service time for each Customer is exponential with mean 4 min and if the people arrive in Poisson fashion at the rate of 10 per hour .

a) What is the probability that a customer has to wait for service?

b) What is the expected percentage of idle time for each girl?

c) if the customer has to wait in the queue, what is the expected length of his waiting time?

Question (49)

The local one man barber shop accommodates a maximum of 5 people at a time (4 wait and 1 getting hair cut). Customers arrive according to a Poisson distribution with mean 5 per hour. the barber cuts hair at an average rate of 4 per hour .Find

a) What percentage of time is the barber idle?

b) What fraction of the potential customer turned away?

c) What is the expected number of customer waiting for hair-cut?

d) How much time can customer expect to spend in the shop?

Question (50)

At a railway station, only one train is handled at a time. The railway yard is sufficient only for 2 trains to wait, while other is given signal to leave the station. Trains arrive at an average rate of 6 per hour and the railway station can handled them on an average of 6 per hour. Assume Poisson arrivals and exponential service distribution, Find

a) Find the probabilities for number of trains in the system?

b) Find the average waiting time of new train coming into the yard?

c) If the handling rate is doubled, how will the above results get modified.

JAGANNATH UNIVERSITY, JAIPUR

QUESTIONS BANK

HYDRAULIC MACHINES & HYDRAULIC POWER PLANT (ME-606)

UNIT-I

1. Define the terms: - (a) impacts of jets

(b) Jet propulsion

2. Obtain an expression for the force exerted by a jet of water on a vertical plate in the direction of the jet.

3. Obtain an expression for the force exerted by a jet of water on an inclined fixed plate in the direction of the jet.

4.Obtain an expression for the force exerted by a jet of water on hinged plate in the direction of the jet.

5.Show that the force exerted by a jet of water on moving inclined plate in the direction of jet is given below:-

$Fx= \rho a (V-u) \sin^2\theta$

6. Differentiate between: - (i) the force exerted by a jet of water on a fixed vertical plate and moving vertical plate.

(II) The forced exerted by a jet of water on a single curved moving plate and a series of curved moving plate.

7. A jet of water of diameter 50 mm moving with a velocity of 40 m/s, strikes a curved fixed symmetrical plate at the center. Find the forced exerted by the jet of water in the direction of jet. If jet is deflected through an angle of 1200 at the outlet of the curved plate.

8. A jet of water of 30mm dia. Strikes a hinged square plate at its center with a velocity 20m/s. The plate is deflected through an angle of 200. Find the weight of the plate. If the plate is not allowed to swing what will be the force required at the lower edge of the plate to keep the plate in vertical position.

9. A jet of water of diameter 10cm strikes a flat plate normally with a velocity of 15m/s. the plate is moving with a velocity 6m/s in the direction of the jet and away from the jet .find;-

I. The force exerted by the jet on the plate
II. Work done by the jet on the plate per second
III. Power and efficiency of the jet.

10. Find an expression for the efficiency o f a series of moving curved vanes when a jet of water strikes the vanes at one of its tips. Prove that maximum efficiency is when u=V and the value of maximum efficiency is 50%.

11. Show that the angle of swing of a vertical hinged plate is given by $\sin\theta=\rho aV^2/W$.

UNIT-2

1. Define hydraulic machines and how hydraulic turbines are classified.

2. What are the types of turbines suitable under the following conditions :

(a) High head and low Discharge

(b) Medium head and mediumDischarge

(c) Low head and large discharge.

3. Construction and working Pelton wheel turbine

4. Write design aspects of pelton wheel and explain Governing of turbines.

5. What do you mean by gross head, net head and efficiency of turbine? Explain the different types of the efficiency of a turbine

6. Calculate the Work done, Efficiency, Working proportions of a Francis turbine.

7. Differentiate between the impulse and reaction turbines

8. The three –jet pelton turbine is required to generate 10000 kw under a net head of 400m. the blade angle at outlet is 150and the reduction in relative velocity while passing over the blade is 5%.if the overall efficiency of the wheel is 80%, C_v=0.98 and the speed ratio = 0.46 then find (i) the dia. Of the jet

(ii) Total flow in m3/s and

(iii) The force exerted by a jet on buckets.

If the jet ratio is not to be less than 10,find the speed of the wheel for a frequency of 50Hz per second and the cross pounding a wheel diameter.

9. Design a pelton wheel under the following specification:-

Shaft power=11,772kw ;head =380m; speed= 750m ;overall efficiency=86%;jet diameter is not exceed one – sixth of the wheel diameter .Determine (i)the wheel dia.(ii)the no. of jets required and (iii) diameter of the jet.

Take Kv1=0.985 and Ku1=0.4

10. A pelton wheel has a mean bucket speed of 10m/s with a jet of water flowing at the rate of 700litrs pe second under a head of 30m. Thebucket deflects the jet through an angle of 1600. Calculate the power given by water to the runner and the hydraulic efficiency of the turbine. Assume co-efficient of velocity as 0.98.

11. In a Pelton wheel, the bucket peripheral speed is 10 m/s, the water jet velocity is 25 m/s and volumetric flow rate of the jet is 0.1m3/s. If the jet deflection angle is120° and the flow are ideal, calculate the power developed by pelton wheel.

12. Explain why penstock pipes are of larger diameter compared to the jet diameters.

UNIT-3

1. Define Radial flow reaction turbine, Francis turbine and explain construction and working.

2. Write and explain design aspects of Francis turbine runner

3. Define Propeller and Kaplan turbine and explain Construction and working.

4. (I) Explain Draft tube theory and governing of reaction turbine.

(II) Working proportions of a Francis turbine design aspects of Francis turbine runner.

5. Write and explain Performance characteristics and comparison of all the turbines.

6. (I) explain the function of draft tube in the case of reaction turbines

(II) Explain why the casing is of spiral shape with uniform change in area, in the case of reaction turbines.

7. (I) explain the function of draft tube in the case of reaction turbines.

(II) Explain the reason for higher part load efficiency in the case of Kaplan turbine as compared to Francis orpropeller units.

8. A reaction turbine works at 450 rpm under a head of 120m .Its dia. at inlet is 120cm and the flow area is 0.4m2. The angle made by absolute and relative velocities at inlet is 200& 600respectively with the tangential velocity. Determine (a) volume flow rate. (b) The power developed and (c) hydraulic efficiency

Assume whirl at outlet to be zero.

9. A Kaplan turbine runner is to be designed to develop 9000kw. The net available head is 5.4m. If the speed ratio =2.09, flow ratio is 0.68, overall efficiency 85% and dia. of the boss is 1/3 the dia. of the runner. Find the dia. of the runner, its speed and the specific speed of the turbine.

10. What is capitation? How does it affect the performance of hydraulic machines?

UNIT-4

1. Define reciprocating pumps, their Classification, component and working.

(I) what is difference between single acting and double acting.

(II) Define slip, percentage slip and negative slip a reciprocating pump

2. Drive the expression for work done, power develop, discharge and co-efficient of discharge of single and double acting reciprocating pump

Define & draw indicator diagram. Prove that work done by the pump is proportional to the area of the indicator diagram.

3. (i) Obtain an expression for the pressure head due to acceleration in the suction and delivery pipes.

(ii) Explain acceleration theory of air vessels and their applications.

6. Write short note on following:-

I. Hydraulic accumulator
II. Hydraulic intensifier
III. Hydraulic Press

7. Write short note on following:-

I. Hydraulic crane
II. Hydraulic lift
III. Hydraulic Ram

8. A single acting reciprocating pump having a bore of 150mm and a stroke of 300mm is raising water to height of 20m above the sump level the pump has an actual discharge of 0.0052m3/s. the efficiency of the pump is 70%.if the speed of pump[is 60rpm . determine

I. Theoretical discharge
II. Theoretical Power
III. Actual power
IV. % slip

9. A double acting reciprocating piston pump is pumping water (dia. of the piston 250mm, dia. of the piston rod, which is on one side of the piston 50mm, piston stroke 380mm).The suction and delivery heads are 4.5m and 18.6m respectively. Find the work done by the piston during outward stroke.

10. Show that in a double acting pump the work saved by fitting air vessels is about 39.2%.

11. A single acting reciprocating water pump of 180 mm bore and 240 mm stroke operates at 40 rpm. Determine the discharge if the slip is 8%. What is the value of coefficient of discharge? If the suction and delivery heads are 6 m and 20 m respectively. Determine the theoretical power. If the overall efficiency was 80%, what is the power requirement?

12.An accumulator maintains a pressure of 6000kN/m^2 in a 50mm diameter hydraulic main.A hydraulic crane situated at a distance of 250m from the accumulator is supplied with pressure water this main. The ram of the hydraulic crane is of 220mm diameter. Velocity ratio of the crane hook is 4:1.A pressure of 280kN/m^2 may be assumed on the ram to account for mechanical friction of ram, pulleys etc. Calculate the load lifted when is raised with a speed of 0.6m/s. Assumed a co-efficient of friction for the hydraulic main as 0.01.

UNIT-5

1. (I) Explain Selection of site for hydroelectric power plant

(II) Explain classification of dams.

2. Write short note on Water power Development and Advantages and disadvantages of water

3. Write and explain essential elements of HEPP in details.

4. Write short note on following terms:-

(I) Hydrological cycle
(II) Hydrograph
(III) Surge tanks

4. Explain Major, mini and micro power plants- present scenario in Rajasthan and India in details.

5. Write short note on following terms:-

(I) Selection of turbines.
(II) Conduits,
(III) Spillways

6. At a hydroelectric power plant site, available head and flow rate are24.5 m and 10.1m^3/s respectively. If the turbine to be installed is required to run at 4.0 revolutions per second (rps) with an overall Efficiency of 90%, then which type of turbine is used for this site and why?

7. Comparison of Hydro-Power Station with Thermal Power Station.

8. At a proposed site of hydroelectric power plant the available discharge and head are 330m^3/s and 28 m respectively. The turbine efficiency is 80%.The generator is directly coupled to the turbine. The frequency of generator is 50Hz and numbers of poles used are 24.Find the least number of machines required if:-

I. A Francis turbine with a specific speed of 260 is used;
II. A Kaplan turbine with a specific speed of 700 is used;

JAGANNATH UNIVERSITY

QUESTION BANK VII SEM

Steam and gas turbine (ME 701)

UNIT 1

Q1. Give principle and working of steam turbine

Q2. Explain in brief types of turbines

Q3.Explain impulse turbine with diagram

Q4.Explain reaction turbine with diagram

Q5.What do you understand by compounding of steam turbine ?

Q6. Explain compounding for pressure in steam turbines ?

Q7. Explain compounding for velocity in steam turbines ?

Q9. Explain compounding for pressure and velocity in steam turbines ?

Q10. Steam issues from the nozzles of a steam turbine with a velocity of 1200 m/s . The nozzle angle is 200 , the mean blade velocity is 400 m/s., and the inlet and outlet angle of blade are equal . The mass of steam flowing through turbine per hour is 900 Kg .Calculate : A) the blade angles B) The relative velocity of steam entering the blades C) The tangential force on the blades D) The power developed E) The blade efficiency. Assume K=0.8.

UNIT 2

Q1.Explain in brief stage efficiency and diagram efficiency ?

Q2. Explain energy losses in steam turbines?

Q3. Give turbine performance at various loads for steam turbines ?

Q4.Explain governing of steam turbines?

Q5. Explain in brief all types of governing in steam turbines

Q6. Describe components of steam turbine in brief ?

Q7.Explain simple throttle governing with the help of diagram

Q8.Compare throttle and nozzle control governing

Q9. Explain

- Internal efficiency
- Isentropic efficiency
- Overall thermal efficiency

Q10. Explain

- Mechanical efficiency
- Relative efficiency
- Generator efficiency
- Electrical efficiency

UNIT 3

Q1. Explain Rankine cycle with a diagram of steam power plant.

Q2.Dry and saturated steam at pressure 11 bar is supplied to a turbine and expanded isentropically to a pressure 0.07 bar . Calculate the following

- Heat supplied
- Total change in entropy
- Heat rejected
- Theoretical thermal efficiency

Q3. Explain reheating in steam power plant .

Q4.A steam turbine plant equipped with a single regenerative feed heater operates under the following conditions.

Initial steam pressure=16.5 bar , initial superheat=930 Cs

Extraction pressure=2 bar exhaust pressure=0.05 bar

Compare the regenerative and non regenerative cycle with respect to the Thermal efficiency

Q5. Explain superheating in steam turbine with required curves and drive its efficiency?

Q6. Explain regeneration in steam turbine with required curves and drive its efficiency?

Q7. Explain regenerative water extraction cycle in steam turbine with required curves and drive its efficiency?

Q8. What are the advantages and disadvantages of reheating in steam turbine cycle?

Q9. Explain different methods of improving thermal efficiency of rankine cycle?

Q10. Steam is supplied to a turbine at 100 bar and 470 0 C. The steam while in expansion is taken out at 12 bar , 2100 for reheating and comes out from reheater at 11 bar and 4700 C and expands to 0.07 bar . The steam rate is 3.1 kg/kwh, The generator efficiency is 0.94 and the heat loss through the turbine casing is 2% of the throttle enthalpy. Calculate the turbine internal and thermal efficiency and the approx condition of the exhaust steam.

UNIT 4

Q1. Explain gas power plant with diagram

Q2.Derive a relation for thermal efficiency for brayton cycle.

Q3. Compare gas turbine with reciprocating engines

Q4.Give all applications of steam turbine

Q5. Explain heat exchange cycle with its ideal curves

Q6. Explain reheat cycle with its ideal curves

Q7. Explain combined reheat and heat exchange cycle with its ideal curves

Q8. Explain intercooled cycle with heat exchange and reheat with its ideal curves

Q9. Explain all ideal cycles with required curves of gas power plant

Q10. Give the classification of gas turbine.

UNIT 5

Q1. Explain practical gas turbine cycles ?

Q2. Describe compressor and turbine efficiencies ?

Q3. Describe pressure losses and mechanical losses?

Q4. Explain polytropic efficiency and Derive a relation for polytropic efficiency ?

Q5. In a gas turbine plant , the air at 100 C and 1 bar pressure is compressed to 12 bar with compression efficiency of 80% . The air is heated in the regenerator and the combustion chamber till its tempearature is raised to 14000 C , and during the process the pressure falls by 0.2 bar . The air then expanded in the turbine and passes to regenerator which has 75% effectiveness , and causes a pressure drop of 0.2 bar . If the isentropic efficiency of the turbine is 85% .Determine the thermal efficiency of the plant.

Q 6. Derive an expression for intermediate pressure in terms of minimum and maximum pressure for a intercooler and reheater of gas turbine cycle for maximum turbine work ?

Q7. A gas turbine set draws in atmospheric air at 1 bar and 150 C; there are two pressure stages with perfect intercooler, and total pressure ratio is 25:1. The max temperature of the cycle is 13000 C as there is one turbine for expansion. A regenerator is used and recovers 70% of the available heat. Determine the efficiency of plant and the ratio of useful work to turbine work. The turbine and compressor efficiencies may be taken as 0.87 and 0.86 resp. Assume mechanical efficiency of whole assembly equal to 0.96 and generator efficiency as 0.98.

Q8. Show the effect of

Pressure ratio

Turbine efficiency

Turbine inlet temperature

on thermal efficiency of gas turbine cycle

Q9. Show the effect of

Compressor efficiency

Compressor inlet temperature

Specific fuel consumption

on thermal efficiency of gas turbine cycle

Q10. Write down general performance of simple cycle with losses

JAGANNATH UNIVERSITY, JAIPUR

QUESTION BANK

SUBJECT:-QUALITY CONTROL & QUALITY ASSURANCE (ME 702)

Unit 1

Q.1 Define term Quality and explain the quality characteristics in detail with example

Q.2 Discuss the following.

a) Difference between Inspection & Quality control.

b) Statistical quality control tools.

Q.3 Write down short notes on following

a) Need of Quality

b) Economics of Quality

Q.4 Give classification of SQC (Statistical Quality Control) with their suitability and advantages.

Q.5 Focus the objectives of inspection and classify the inspection methods and also discuss their limitations.

Q.6 Define the term quality specification and accommodate the quality characteristics, which are necessary to enhance productivity.

Q.7 Prepare a comparative sheet of SQC tools as per their application, also show each tool with help of graph.

Q.8 Discuss causes and effect diagram and gives its practical implication in industry to solve typical case studies.

Q.9 Emphasize the role of quality characteristics in tangible and intangible industry with example.

Q.10 Discuss the following.

a) Difference between Inspection & Quality control.

b) Quality Characteristics.

Unit 2

Q.1 The number of weekly customer complaints are monitored at a large hotel using a c-chart. Complaints have been recorded over the past twenty weeks. Develop three-sigma control limits using the following data

Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
No. of Complaints	3	2	3	1	3	3	2	1	3	1	3	4	2	1	1	1	3	2	2	3	**44**

Q.2 Discuss the following.

a) Classification of control charts with their limits and application.

b) Process capability and its three conditions.

Q.3 Discuss the following.

a) Variables and Attributes charts.

b) Process capability and its methods of determination

Q.4 Draw p chart and c chart with their UCL and LCL, also with their example and application

Q.5 A quality control inspector at the Cocoa Fizz soft drink company has taken twenty-five samples with four observations each of the volume of bottles filled. The data and the computed means are shown in the table. Prepare X bar chart to show the process in limit or out of limit, take A2=0.73

.

	Observations					
sample	(bottle volume in ounces)				Average	Range
number	1	2	3	4	X	R
1	15.85	16.02	15.83	15.93	15.91	0.19
2	16.12	16.00	15.85	16.01	15.99	0.27
3	16.00	15.91	15.94	15.83	15.92	0.17
4	16.20	15.85	15.74	15.93	15.93	0.46

Q.6 A production manager at a tire manufacturing plant has inspected the number of defective tires in twenty random samples with twenty observations each. Following are the number of defective tires found in each sample:

Sample Number	Number of Defective Tires	Number of Observations Sampled	Fraction Defective
1	3	20	.15
2	2	20	.10
3	1	20	.05
4	2	20	.10

5	1	20	.05
6	3	20	.15
7	3	20	.15
8	2	20	.10
9	1	20	.05
10	2	20	.10

Prepare p chart to show the chart in limit or out of limit

Q.7 Prepare a case study ,showing the significance of control charts in process industry.

Q.8 Give detailed classification of Attributes and Variables charts with their application.

Q.9 Define the term process capability, showing its importance in minimizing rejection level, also the draw the graph.

Q.10 Discuss the following.

a) X bar, R, C, P chart.

b) Role of process capability in process industry

Unit 3

Q.1 Define Acceptance sampling, also classify sampling plan and explain them with Example.

Q.2 Discuss the following.

(a) Quality audit and its types

(b) Quality control Vs Quality Assurance

Q.3 Discuss the following.

(a) Type I error and Type II error

(b) Quality control Vs Quality Assurance

Q.4 Explain all necessary phases to obtain the certification of quality assurance.

Q.5 Prepare a case study on sampling, also discuss the advantages and disadvantages of sampling Process.

Q.6 Define the term Quality Audit and give classification of Quality Audit with their examples.

Q.7 Prepare a list of differences between Quality control and Quality Assurance, followed by a case Study.

Q.8 Explain the Type I error and Type II error with the help of graph, along with suitable example.

Q.9 Differentiate between single, double and sequential sampling plans with example and their Application.

Q.10 How to conduct Quality assurance program, discuss its stages, which are required to obtain QA certification.

Unit 4

Q.1 Justify the significance of term reliability also discuss the modes of reliability with examples.

Q.2 Discuss the following with supportive examples

a) MTTF (Mean time to failure)

b) MTBF (Mean time between failures)

c) MTTR (Mean time to Repair)

Q.3 Prepare a case study on condition monitoring of Hydraulic system.

Q.5 Define the term value engineering and explain its phases to conduct in industry.

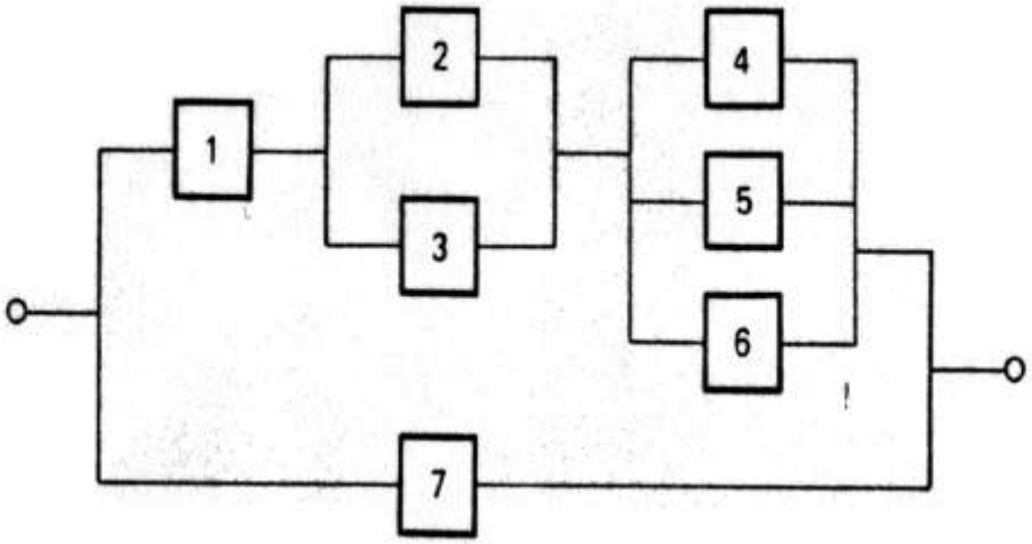
Q.6 Give classification of maintenance and discuss importance of each type of maintenance with example.

Q.7 Discuss the following with supportive examples

a) Bath tub curve

b) Value Engineering.

Q.8 Derive the general expression for reliability of model shown in fig. and also calculate the system reliability and unreliability, if all component have reliability of 0.9



Q.9 Draw the layout of M/C based on series and parallel arrangement and derives the relation to evaluate the system reliability.

Q.10 Prepare a list of differences between Reliability and Quality, followed by a case study

Unit 5

Q.1Define the term TQM (Total quality management) and explain the phases which are used in implementation of TQM

Q.2 Explain the term Quality circle and show how phases of Quality circle are useful in enhancing quality of a system.

Q.3 Focus the contribution of Deming in field of quality, also discuss the fourteen principles of Deming.

Q.4 Discuss the following with supportive examples

a) 5S concept

b) 6 sigma concept.

Q.5 Discuss the following with supportive examples

a) JIT System

b) Zero defect concepts.

Q.6 Explain all the phases which are used in implementation of 6 sigma.

Q.7 Describe the series of ISO: 9001-2000 with their application to quality standards.

Q.8 Focus the role of master black belt, black belt, green belt and white belt in

Conducting 6 sigma program.

Q.9 Write down short notes on following

a) Quality Circles

b) Taguchi's concept

Q.10 Discuss the following with supportive examples

a) KAIZEN

b) Quality Circles

JAGANNATH UNIVERSITY

Question Bank

Mechatronics & Robotics (ME:703)

UNIT 1

Q1. Explain the term 'Mechatronics'. What is the scope of Mechatronics?

Q2. Give atleast four definitions of Mechatronics.

Q3. Explain the components of mechatronics.

Q4. Explain Mechatronics design process and draw its flow chart.

Q5. Define N/C machines and enlist its applications.

Q6. What do you understand by process control automation?

Q7. Explain the need of Mechatronics system in the industrial advancements.

Q8. Give a wide range of industrial applications of mechatronics systems.

Q9. Give a note on advantages and disadvantages of mechatronics.

Q10. How mechatronics can be used for non industrial applications.

UNIT 2

Q11. Enumerate the various stages involved in the design of a system.

Q12. Explain traditional and mechatronics designs.

Q13. Design a mechatronic system for lift control.

Q14. Design a mechatronic system for CNC lathe.

Q15. Design a system for temperature control of a heat treatment furnace.

Q16. Give steps of designing for grey grain separators and EOT crane control panel.

Q17. Why it is required to design a system?

Q18. Give a note on the benefits of a good mechatronics designed system.

Q19. Explain embedded systems used in designing of mechatronic system.

Q20. Why synchronization between the different parts of system necessary?

UNIT 3

Q21. Define the term 'Robotics'.

Q22. What are the important areas of robotics?

Q23. State the laws of robotics.

Q24. How does a robot differ from an automated machine?

Q25. Explain robot anatomy and human arm characteristics.

Q26. Enumerate the industrial capabilities of robots.

Q27. Why it is required to program robots?

Q28. Give a brief introduction about offline and online robot programming.

Q29. Why it is necessary to use notations during the study of robots? Explain some of the notations used in the industrial robots.

Q30. Give future prospects about robots.

UNIT 4

Q31. What do you understand by 'Sensing'?

Q32. What is the purpose of sensors in robots?

Q33. What kinds of sensors are used in robotics?

Q34. Explain tactile and non tactile sensors.

Q35. Give a brief note on proximity sensors.

Q36. What do you understand by range sensors? Explain with a suitable diagram.

Q37. Explain the industrial application of sensor controlled robots.

Q38. Explain process of imaging.

Q39. Explain the architecture of robotic vision system.

Q40. Give a note on image acquisition.

UNIT 5

Q41. What do you understand by transducers?

Q42. What are the functions of a transducer in an electronic instrumentation system?

Q43. Give a note on classification of transducers.

Q44. What are the advantages of electromechanical transducers?

Q45. What is the principle on which a capacitive transducers?

Q46. What are the advantages of capacitive and inductance transducers:?

Q47. Give a note on non industrial applications of robots.

Q48. How robots can be used for assembly applications?

Q49. How robots can be utilized for inspection and material handling?

Q50. Explain the principle on which the robot application works.

JAGANNATH UNIVERSITY

Question Bank

PRODUCT DESIGN &DEVELOPMENT(ME:704)

Unit-1

1. Explain the morphology of generic product design process with help of suitable block diagram?

2. Define the product and new product? Write down classification of new product and explain them.

3. What r are the prerequisites for new product development? How does product development team help in it?

4. Write brief notes on

- Market pull products
- Customized products
- Plate form based products

5. Describe methods to identity a need. Also describe engineering statement of problem?

6. Explain the procedure to carry out concept of feasibility and concept selection.

7. Write briefly on

- Design compatibility
- Design analysis
- Design synthesis

8. Explain all the phase of morphology of design in detail.

9. Draw product consumption cycle and explain it.

10. What do you mean by product design? How design by evolution is differ from design by innovation? Explain the suitable example

Unit-2

1. Define industrial design? How important is industrial design to a product design?

2. What are the critical goals of industrial designer? Explain the steps in industrial design process for a new product..

3. Define industrial design? Explain difference between Industrial and engineering design.

4. Explain Product Management's Challenges faced by an industrial designer?

5. What is role of Industrial Designer for an organization? Explain Problem faced by Industrial Designer

6. Explain role of ergonomics and aesthetics in product design?

7. Explain the composition and role of various components in design team staffing and organization

8. What do you mean by product value? What are the different parameters to increase the value of product?

9. Explain the different strategy adopted by designer. how is time important for products designer

10. Define industrial design? Explain Principles of modern design

Unit-3

1. Explain Preliminary design process and its sub systems with suitable block diagram?

2. Explain detailed design and its sub systems with suitable block diagram?

3. Define product design? Explain Conceptual design method of product design with suitable flow diagram?

4. Write short notes on methods product design development

(a)Conceptual design method

(b)Descriptive design method

5. Write briefly on :

- Brain storming
- innovation in design
- invention in design

6. How is need analysis done for new products? What is ergonomic existence of need?.

7. Explain different requisites for prepare an assembly drawings in product design

8. What factors influences the identification of subsystems? Explain preliminary design sub systems

9. Explain the different factors associated with design for safety, reliability, and environment considerations

10. Explain following

- design analysis
- design synthesis
- prototyping

Unit-4

1. What is brain storming?? Difference between sequential design and concurrent design.

2. What is DFM? Explain methodology of DFM process with help of suitable block diagram?

3. What is DFM? Explain DFM Tools, Methodology and DFM Product Considerations.

4. What is DFA? Write importance of DFA and DFM.

5. Explain the DFM&DFA principle‘s with suitable example.

6. Explain the role of computer in product design and manufacturing?

7. Explain the different ideas for material saving in design? What are the criteria and objective of balanced design?

8. Explain following

- Design for quality
- Rapid physical prototyping

9. What are design resources? Explain the Legal issues in product design.

10. Define concurrent engineering? How is it important in product design and development?

Unit-5

1. What are 5’ S? Explain 5’S Principles used to analysis of the products.

2. Write brief on :

    (a) Environmental consideration in product design.

    (b) Economics of new product design.

3. Explain following:

    (a) Role of aesthetics in product design.

    (b)) Explain the product life cycle.

4. Explain Life cycles of products.

5. Explain Procedure adopted by Industrial Designer

    (a) Role of aesthetics in product design

    (b) Functional design practice

6. Explain any two from following

    (a) Environmental consideration in product design

    (b) Economics of new product design.

7. Write brief on :

    (a) Environmental consideration in product design

    (b) Ergonomics of new product design

8. Explain any two from following

    (a) Design for safety

    (b)Design for reliability

9. What are three S’s? Explain with suitable example .difference between aesthetic and functional design.

10. What factors will you consider for designing good working environment for a product?

JAGANNATH UNIVERSITY

Question Bank

NON CONVENTIONAL ENERGY SYSTEMS (ME705)

Unit 1

Q 1: What are the conventional and Non-conventional energy sources? Describe briefly.

Q2: What are the Indian and global energy sources? Describe briefly.

Q3: What are forms and characteristics of renewable energy sources?

Q4: What are the various nonconventional energy sources of India?

Q 5: What are the limitations of renewable energy sources?

Q 6: What is solar thermal power conversion to electricity? Explain solar thermal power plant with block diagram and its various components.

Q 7: What are various types of solar collectors? Explain them.

Q8: What are flat plate collectors and its type? Explain them.

Q 9: What are various concentrating collectors? Explain them in brief.

Q 10: What are advantages and disadvantages of flat plate collector over concentrating collectors?

Q11: What are various applications of solar thermal energy?

Q 12: What are various methods used for storing solar thermal energy? Explain in brief.

Q 13: What is photovoltaic effect? How solar energy converted to electrical energy by this method. Show block diagram for solar energy photovoltaic cell.

Q 14: Write notes on followings

a) Semiconductor materials for solar cell

b) Solar photovoltaic cell systems

Q 15: What are various applications of photovoltaic system? Explain them.

Q 16: Explain solar radiation and its measurements procedure.

Unit 2

Q 1: what is the basic principle of wind energy conversion? Write a note on availably of wind energy in India.

Q 2: What is wind turbulence and atmospheric circulations?

Q 3: Explain in detail the applications of wind energy conversion systems.

Q 4: Describe various classifications of Wind energy conversion systems.

Q 5: Describe with neat sketch the working of wind energy systems with main components.

Q 6: Explain various factors influencing wind energy

Q 7: Write notes on

- Horizontal axis wind mill
- Vertical axis wind mill

Q 8: What are the various methods used for wind energy generation. Describe them in brief.

Q9: Explain wind shear and wind speed monitoring.

Q10: Explain Betz limit and derive an expression for this.

Unit 3

Q 1: What is the basic principle of ocean thermal energy conversion?

Q 2: What is ocean thermal energy and principle of ocean thermal energy conversion?

Q 3: Explain in detail the open cycle of ocean thermal energy conversion systems.

Q 4: Describe various types of ocean thermal energy conversion plants

Q 5: Describe various prospects of ocean thermal energy conversion systems in India.

Q 6: Write advantages and disadvantages of OTEC system.

Q7: Explain in detail the closed cycle of ocean thermal energy conversion systems.

Q8: How the ocean thermal energy conversion system work. Explain in detail?

Q9: Write a note on availability of ocean thermal energy in India?

Q10: Explain the advantages of OTEC over other renewable energy sources?

Unit 4

Q 1: Define Biomass and Bio gas. Explain various sources of Biomass.

Q 2: Explain the process photosynthesis. What are the conditions required for this process.

Q 3: What are the various processes of biogas generation? Explain in detail.

Q 4: Write notes on following?

a) Raw materials for biogas

b) Properties of biogas

c) Transportation of biogas

d) Fuel properties of biogas

Q 5: How biogas plants are classified? Explain them briefly.

Q 6: What is a community biogas plant? What are the main problems encountered in its operation.

Q 7: Write main applications of biogas.

Q 8: What are various biomass conversion techniques? Explain them in brief.

Q 9: What is biomass gasification? Explain in detail.

Q10: What are various methods used for energy generation from biomass?

Q 11: Write notes on followings

a) Power generation from liquid waste

b) Energy generation from urban water

Unit 5

Q 1: Define wave energy and explain various wave energy conversion devices.

Q 2: Explain magneto hydrodynamic (MHD) power generation and its principle.

Q 3: Write various systems of MHD power generation.

Q 4: Explain Tidal Energy and its principle of power energy conversion.

Q 5: Explain single basin tidal power generation systems of tidal energy.

Q 6: What do you understand by wave energy and tidal energy explain.

Q 7: Explain double basin tidal power generation systems of tidal energy.

Q 8: What are the advantages and limitations of tidal power generation.

Q 9: What is MHD? Give its principle of power generation.

Q 10: List out the advantages of tidal power plant over hydro power plant.

Q 11: What are the factors to be considered for suitable site selection of tidal power plant

Question Bank

Noise and Vibration(ME706)

Unit 1

Q1 what is the major source of the noise. And describe the industrial noise.

Q2 what is the difference between the Non-Auditory effects and auditory effects of the noise

Q3 Write the short notes on

- Noise control along the path
- Noise control at the receiver

Q4 Write the short notes on

(a) Acoustic barriers

(b) Industrial noise control-strategies

Q5 Described the Noise effect, Rating, and Regulations

Unit 2

Q. 1 Determine the effect of mass of spring on natural frequency of the system as shown fig

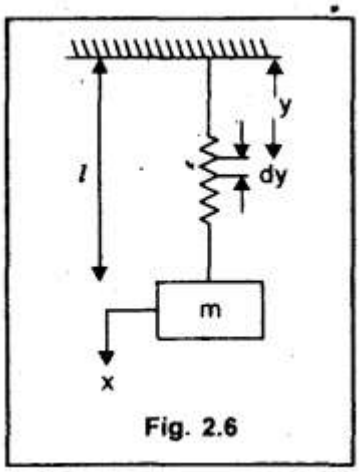


Fig. 2.6

Q. 2 Determine the natural frequency of spring controlled simple pendulum as shown in Fig.

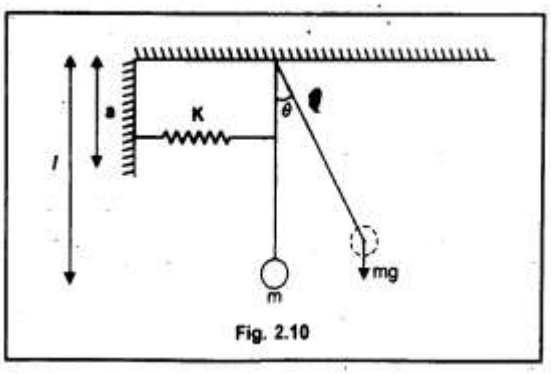
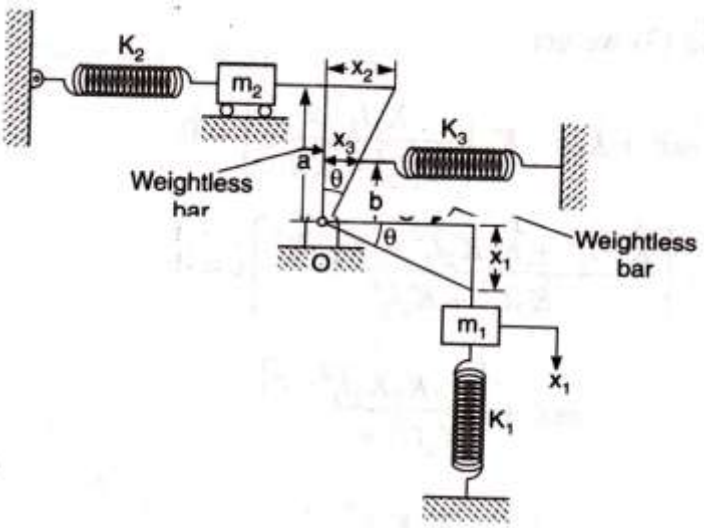
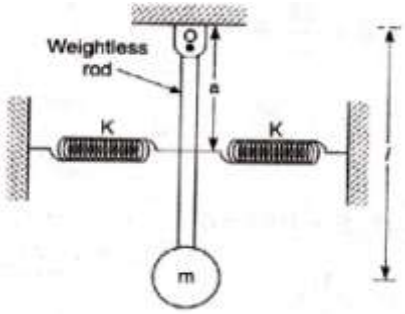


Fig. 2.10

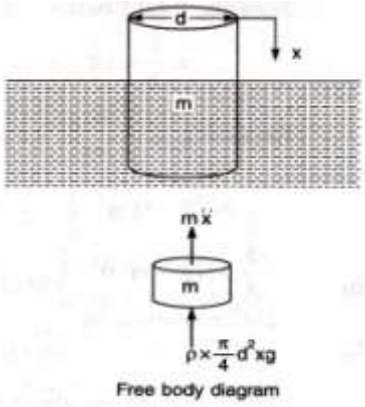
Q3 Determine the natural frequency of the system by energy method (Shown in displaced position)



Q 4 Determine the natural frequency of the system by energy method (Shown in displaced position)



Q5 A block of circular cross section having diameter 'd' and mass M floats vertically in a liquid of mass density ρ as shown in fig. A small displacement is given verticality down load and released. Find the period of its oscillation.



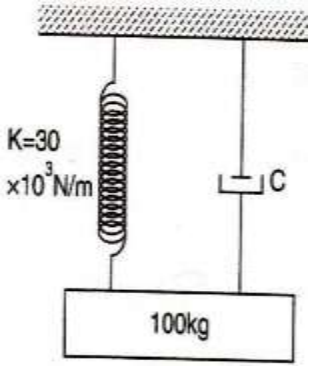
Q. 6. What is the response of single degree of freedom system with viscous damping when it is:

(*a*) Underdamped ($\varepsilon < 1$)

(*b*) Critically damped ($\varepsilon = 1$)

(*c*) Over damped ($\varepsilon > 1$).

Q7 If the damping provided is only 25% of the critical value, find out



(i) The damping factor

(ii) The critical damping coefficient

(iii) The natural frequency of damped vibration

(iv) The logarithmic decrement

(v) The ratio of two consecutive amplitude

Q8 as shown in fig A tensional pendulum with a disc of moment of inertia I = 0.06 Kgm2. The pendulum is immersed in viscous liquid. During vibrations of pendulum, the successive amplitude decays with 66.6% of initial value Take G =4.4x1010 N/m2 for shaft

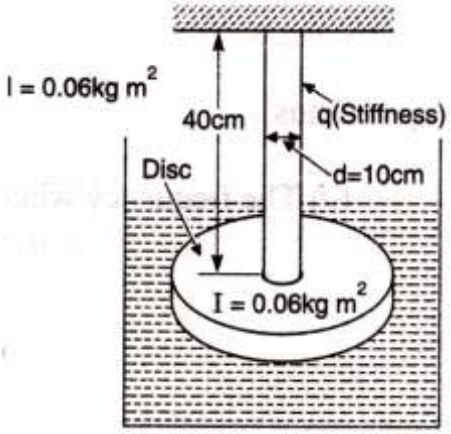
Find out

(a)logarithmic decrement

(b) Damping torque per unit velocity

(c)The periodic time of vibration

(d)The frequency when the disc is removed from the liquid.



Q. 9. Derive the relation for natural frequency of the compound pendulum.

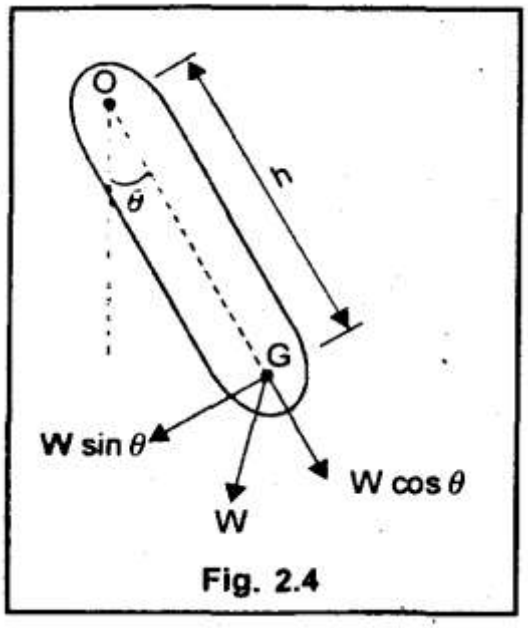


Fig. 2.4

Q. 10 Determine the natural frequency of spring mass pulley system as shown in Fig.

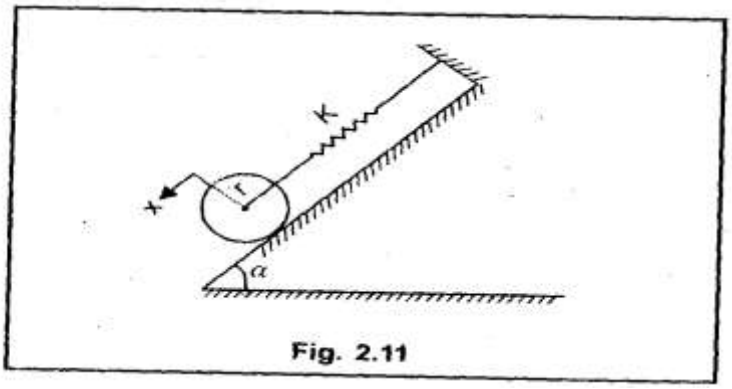


Fig. 2.11

Unit 3

Q1 what is forced vibrations. Derive an expression for amplitude and phase difference for a subjected to harmonic excitation (F0sinωt)

Q2 In forced vibration prove that

(i) $\frac{\omega max}{\omega n}=\sqrt{1-2\varepsilon^2}$

(ii) $\frac{A}{x_s}=\frac{1}{2\varepsilon}$

Q3 A machine of 100 Kg mass is supported on spring of total stiffness 700KN/M and has an Un balanced rotating element which result in a disturbing force of 350N. at a speed of 3000 R.P.M. Assuming a damping ratio of ξ= 0.2 Determine

(a) It's amplitude of motion due to unbalance

(b) Transmissibility

(c) Transmitted force

Q.4 Analyze the system having forced vibrations due to reciprocating unbalance.

Q.5 Derive that relation for displacement transmissibility in case of support

Q. 6 A vibrating body having mass 1 kg is suspended by a spring of stiffness 1000 N/rn and it is put to harmonic excitation of 10 N. Assuming viscous damping, determine;

(a) The resonant frequency

(c) Amplitude at resonance

(b) Phase angle at resonance

(d) Frequency corresponding to peak amplitude

(e) Damped frequency.

Take c =40 N - sec/m

Q. 7 Prove that transmissibility $$(T.R.) = \frac{\sqrt{1+(2\varepsilon r)^2}}{\sqrt{(1-r^2)^2+(2\varepsilon r)^2}}, \text{ where } r = \frac{\omega}{\omega_n}.$$

Q. 8. What is vibration isolation ? What are the commonly used materials for vibration analysis.

Q. 9. Derive the response of the system in which mass is having relative motion with respect to support

Q. 10 The total mass of the system having rotating unbalance is 25 kg. At speed of 1000 rpm, the system and the eccentric ma have a phase angle of 90° and the corresponding amplitude is 1.5 cm. The eccentric unbalance mass of 1 kg has radius of rotation 4 cm. Determine:

(a) Natural frequency of the system

(b) The damping factor

(c) The amplitude at 1500 rpm

(d) The phase angle at 1500 rpm.

Unit 4

Q.1 what is a two degree system?

Q. 2 What is the difference between a vibration absorber and a vibration isolator?

Q. 3 What are vibration absorbers? Prove that spring force of the absorber system is equal and opposite of the excitation force for main system to be stationary?

Q.4 Discuss the effect of mass ratio on natural frequency of the vibration absorber.

Q. 5 what are the disadvantages of dynamic vibration absorber?

Q. 6 prove that all frequency of centrifugal pendulum absorber is always proportional to the speed of rotating body.

Q. 7 determine the two natural frequencies of vibration and the ratio of the amplitudes of motion of mass m1 and m2 for the system shown in Fig. 5.11.

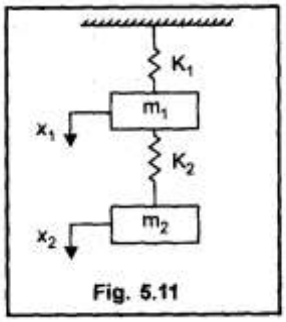


Fig. 5.11

Q. 8 Solve the problem shown in Fig. 5.12; m1 10 kg, m2 = 15 kg, k = 320.N/m.

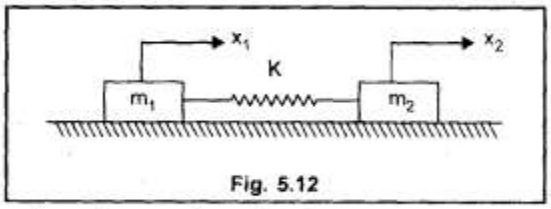


Fig. 5.12

Q. 9 A machine runs at 5000 rpm. Its forcing frequency is very near to its natural frequency. If the nearest frequency of the machine is at least 20% from the forced frequency, design a suitable vibration absorber for the system. Assume the mass of the machine as 30 kg.

Q10 write the short notes on

(i) Dynamic vibration Absorber

(ii) Define order No.

Q. 11 Find the natural frequencies of the there is no slip between cord and cylinder.
system shown in Fig. 5.14. Assume that

Given :

$k_1 = 40$ N/m
$k_2 = 60$ N/m
$m_1 = 2$ kg
$m_2 = 10$ kg

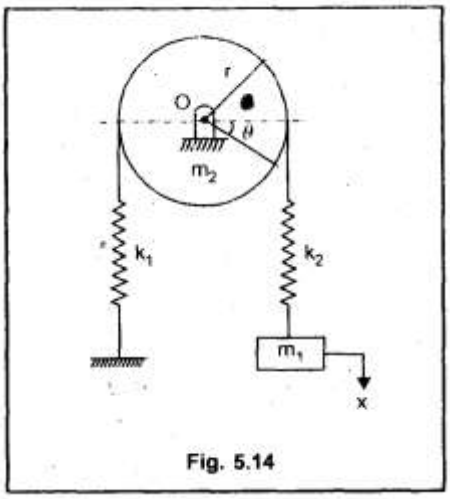


Fig. 5.14

Unit 5

Q. 1 Define the Dunkerley's Method and prove the relation

$$\frac{1}{\omega^2} = \frac{1}{\omega_1^2} + \frac{1}{\omega_1^2} + \frac{1}{\omega_1^2} + \cdots$$

Q2 Define the Rayleigh's Method. And prove the relation

$$\boldsymbol{\omega} = \sqrt{\frac{g \sum Py}{\sum Py^2}} \text{ rad/sec}$$

Q. 3. Find the lowest natural frequency of vibration for the system shown in Fig. 6.6 by Rayleigh's method.

$E = 1.96 \times 10^{11}$ N/m^2 ; $I = 4 \times 10^{-7}$ m^4

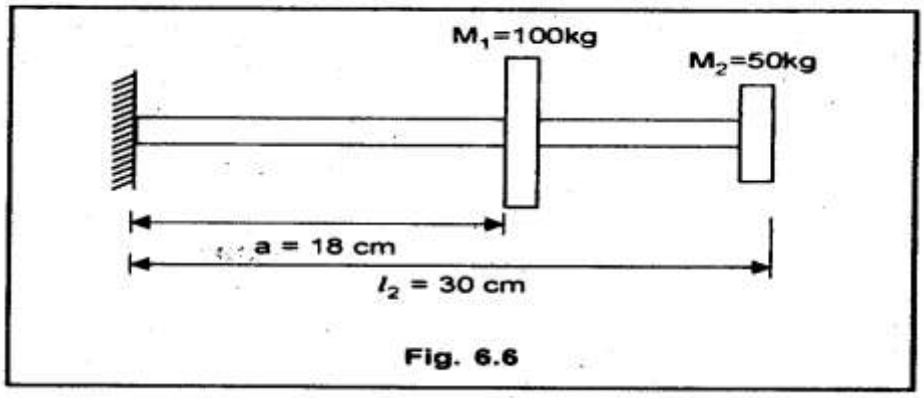


Fig. 6.6

Q.4. Use Stodola's method to find the natural frequency of the system shown in Fig. 6.9.

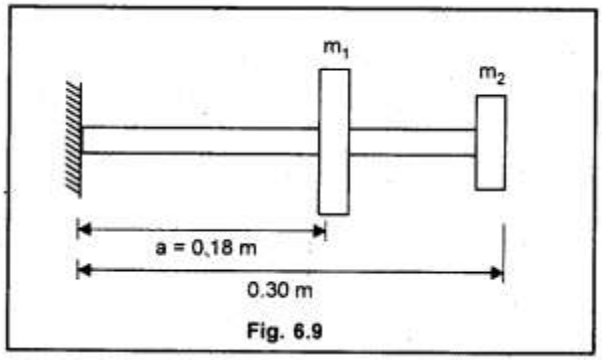


Fig. 6.9

Q.5 A shaft of negligible weight, 6 cm diameter and 5 meters long is simply supported at the ends and carries four weights 50 kg each at equal distance over the length of the shaft. Find the frequency of vibration by Dunkerley's method. Take E =2 x 106 kg/cm2.

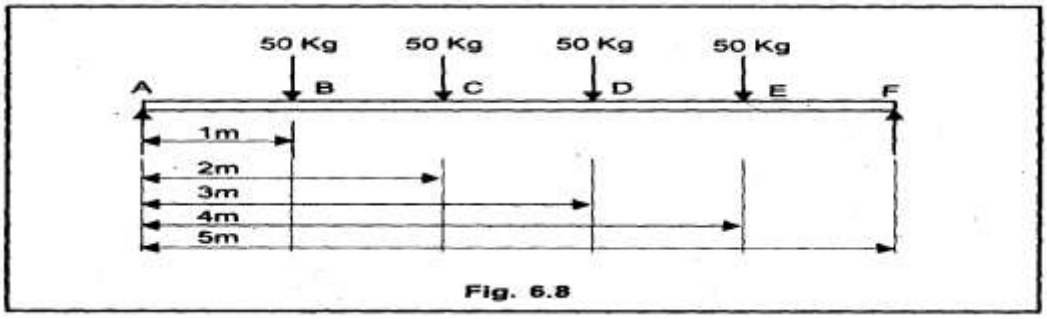


Fig. 6.8

Q 6. Explain Holzer method with suitable example.

Q. 7 Determine the influence coefficients of the system shown in Fig. 6.10.

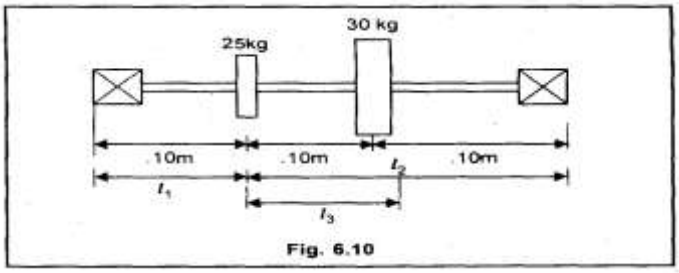


Fig. 6.10

Q. 8 Use Hoizer method to find the natural frequencies of the system shown in Fig. 6.12

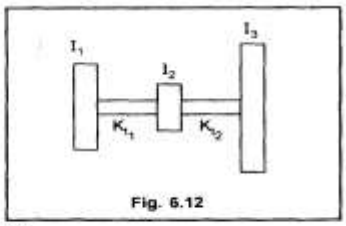


Fig. 6.12

Take $I_1 = I_2 = I_3 = 1$ kg-m^2

$K_{t_1} = K_{t_2} = 1$ N-m/rad.

Q. 9 Calculate the natural frequency and mode shapes of the vibrating string as shown in figure below, by influence coefficient method.

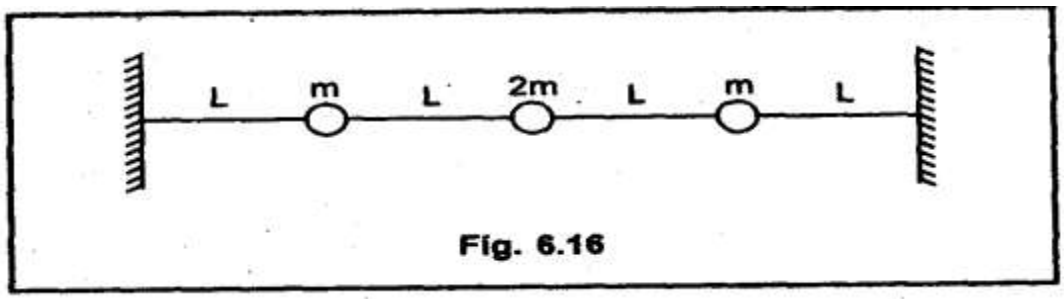


Fig. 6.16