

6E3050

Roll No. _____

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6E3050**B.Tech. Vth Semester (Main/Back) Examination, June - 2010****Mechanical Engineering****I.C. Engines & Diesel Power Plant****Time : 3 Hours****Maximum Marks : 80****Min. Passing Marks : 24****Instructions to Candidates:**

Attempt any five questions selecting one question from each unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)

Unit - I

1. a) Explain with neat sketch the working of a four stroke S.I. engine. Draw P - V diagram also.

b) The following data relates to a two stroke single cylinder diesel engine using a blend of oil :

Cylinder bore = 200mm

Engine stroke = 250mm

Indicated mean effective pressure 500 N/m²

Fuel consumption per hour = 6.5 kg

Calorific value of fuel = 44000 kJ/kg

Engine speed = 3 revolution per second calculate the indicated power of engine and its indicated thermal efficiency.

OR

a) How I.C. engines are classified? Explain. Draw a chart indicating classification of I.C. engine.

- b) The following data relates to a four stroke single cylinder gas engine :
- Cylinder bore and stroke = 300mm and 375mm respectively.
Net load on the brake = 900 N
Duration of test = 45 minute
Engine revolution = 9450
Engine explosions = 3600
Effective brake radius = 800mm
Mean effective pressure = 600 kPa
Gas consumed = 9.0 m³
Calorific value of gas = 18.5 MJ/m³.
- Calculate indicated power, brake power & brake thermal efficiency.

Unit - II

2. a) Explain the effect of engine variables on ignition lag in S.I. engine.
b) Explain compression Swirl. What are the advantages of compression Swirl in C.I. engine?

OR

- a) Explain the theories of detonation in S.I. engine.
b) Explain the need of additives in the fuels. What are the effects of various additives in engine fuels?

Unit - III

3. a) What are basic requirements of a spark ignition system? Describe working of spark ignition system used in a four cylinder petrol engine.
b) What are the requirements of a diesel injection system? Compare air injection and solid injection

OR

- a) Describe the special features of aircraft carburettor. What are the drawbacks of modern carburettors?
b) What is the effect of variation of air-fuel ratio on performance of engine? The venturi of a simple carburettor has a throat. Which has diameter of 20mm. The diameter of fuel orifice is 1.20mm and the co-efficient of air flow is 0.85 and that of fuel flow is 0.65. If the petrol surface is 5mm below the throat, find the air-fuel ratio for a pressure drop of 0.07 bar.

Take density of air and fuel as 1.2 and 750 kg/m³ respectively and neglect nozzle I.P.

Unit - IV

4. a) What are the functions of the lubrication system used in I.C. engine? Describe.
- b) What are the effects of supercharging on power output. Mechanical efficiency, fuel consumption and cooling of an engine? What are the limitations of supercharging?

OR

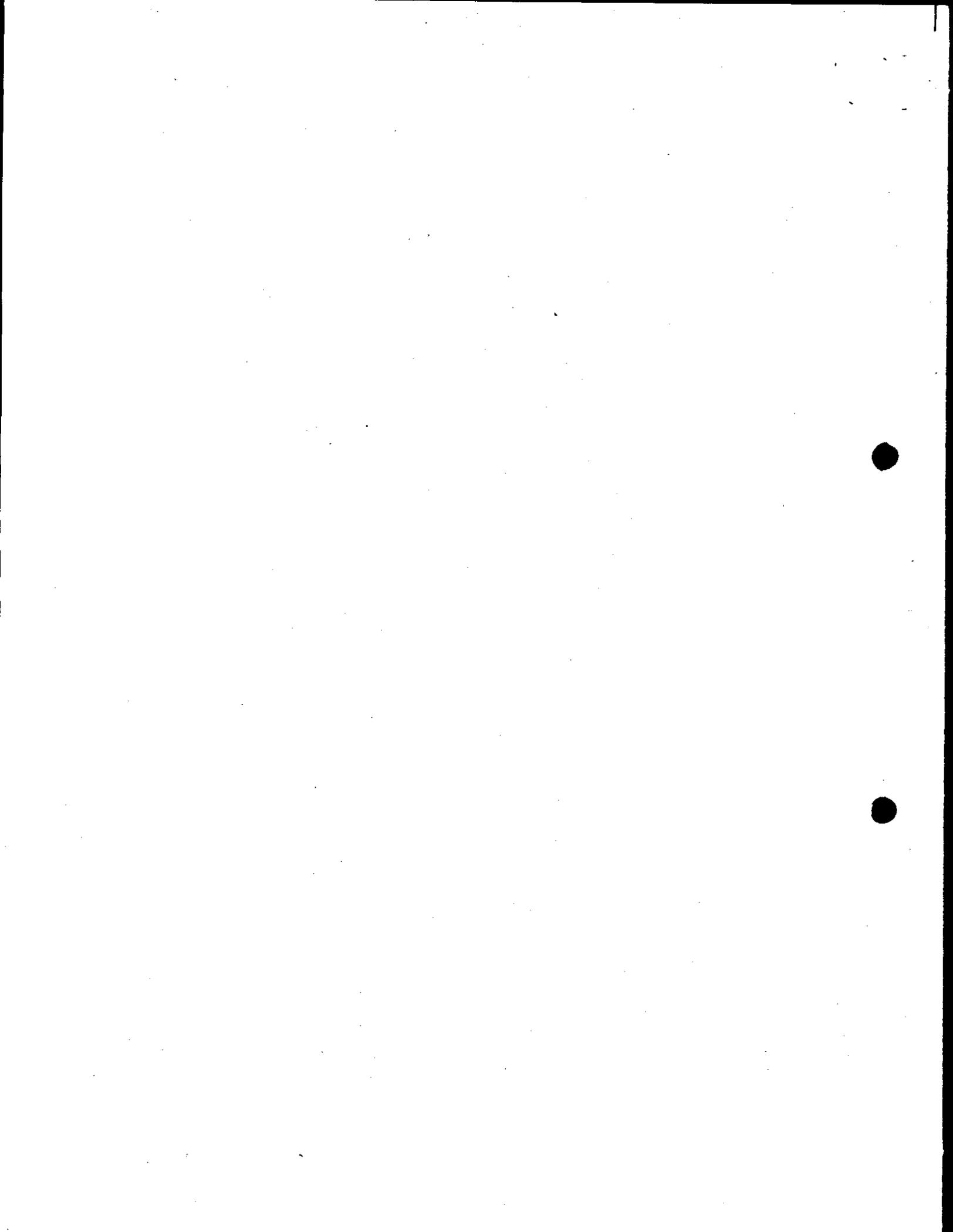
- a) Describe with neat sketch different methods of supercharging. Explain thermodynamics cycle of supercharging.
- b) Describe with neat sketch cooling system of a four stroke S.I. engine used in car. What are the components used in cooling system?

Unit - V

5. a) Describe the stages of combustion in a dual fuel engine. When gaseous fuel is injected in small quantity near top dead centre.
- b) What is the effect of variable compression ratio on power output, thermal load, specific fuel consumption and engine noise?

OR

- a) How the performance of a variable compression ratio engine differs from that of a convention engine? Compare.
- b) What factors effect the capacity of a diesel power plant? Describe safety steps taken in a diesel power plant.
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6E3051**B.Tech. VIth Semester (Main/Back) Examination, June - 2010****Mechanical Engineering****6ME3 Manufacturing Science & Technology****Time : 3 Hours****Maximum Marks : 80****Min. Passing Marks : 24****Instructions to Candidates:**

Attempt any five questions selecting one question from each unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)

Unit - I

1. Explain 3-2-1 principle of locating a part from external surface. Explain with neat sketches, how a part can be located from holes? (8+8)

OR

Describe the materials used and their suitability for jigs and fixtures? Explain various turning fixtures. (8+8)

Unit - II

2. a) Explain specific applications of new machining methods. (6)
b) Explain Abrasive Jet machining and its process characteristics. (6+4)

OR

- a) Explain working of Laser Beam machining with neat sketch. (8)
b) Give a comparison of various new machining methods based on material removal rate, process mechanism, power consumption, application, tool material, accuracy etc. (8)

Unit - III

3. Explain 2 wire method of effective diameter measurement of a screw thread. Explain RMS value and CLA value of surface roughness. (10+6)

OR

List the applications of comparators. Explain the working of an autocollimator. (6+10)

Unit - IV

4. Explain the functions of rake angle, tool angle and cutting angle. Derive the formula for various force components on a single point cutting tool in orthogonal cutting. (6+10)

OR

Explain the angle of contact and force analysis for a slab milling cutter. Explain dimensional analysis for force in a milling cutter. (8+8)

Unit - V

5. What are the requirements of a lathe bed? Describe various bed sections of a lathe and their applications. Explain the use of reinforcing stiffeners. (4+8+4)

OR

Explain the theoretical aspects of design of guideways. Explain antifriction guideways with neat sketches. (8+8)

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6E3053**B.Tech. VIth Semester (Main/Back) Examination, June - 2010****Mechanical Engineering****6ME5 Hydraulic Machines & Hydroelectric Power Plant****Time : 3 Hours****Maximum Marks : 80****Min. Passing Marks : 24****Instructions to Candidates:**

Attempt any five questions selecting one question from each unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)

Unit - I

1. a) Prove that for a curved radial vane the efficiency is given by

$$\eta = \frac{2(V_{w_1}u_1 + V_{w_2}u_2)}{V_1^2} \quad (8)$$

- b) A Francis turbine of diameter 3m develops 6750 kw at 300 rpm under a net head of 45m. A geometrically similar model of scale ratio 1 : 8 is to be tested at a head of 9m. Estimate the size, speed, discharge and power developed by model. What is the specific speed of the model?

(Assume overall efficiency of 0.82 for both the prototype and model). (8)

2. a) A jet of water having a velocity of 18 m/s strikes a curved vane which is moving with a velocity of 6 m/s. The vane is symmetrical and so shaped that the jet is deflected through 120°. Determine : (8)

- The angle of the jet at inlet of the vane so that there is no shock.
- The absolute velocity of the jet at outlet in magnitude and direction.
- The work done per N of water.

- b) A jet of water 60 mm diameter strikes a curved vane at its centre with a velocity of 18 m/s. The curved vane as moving with a velocity of 6 m/s in the direction of the jet. The jet is deflected through an angle of 165°. Assuming the plane to be smooth, find :

- i) Thrust on the plate in the direction of jet.
- ii) Power of the jet and
- iii) Efficiency of the jet. (8)

Unit - II

3. a) Give comparison between Impulse and Reaction turbine. (6)
- b) The propeller reaction turbine of runner diameter 4.5 m is running at 48 r.p.m. The guide blade angle at inlet is 145° and the runner blade angle at outlet is 25° to the direction of vane. The axial flow area of water through the runner is 30 m^2 . If the runner blade angle at inlet is radial. Determine : (10)
- i) Hydraulic efficiency of the turbine,
 - ii) Discharge through the turbine, and
 - iii) Power developed by the runner.
4. a) Derive an expression for hydraulic efficiency of a Pelton wheel. (8)
- b) Describe with a neat sketch the governing of impulse turbine. (8)

Unit - III

5. a) Draw a schematic diagram of a Francis Turbine and explain briefly its construction and working. (8)
- b) A kaplan turbine develops 22000 kw at an average head of 35 m. Assuming a speed ratio of 2, flow ratio of 0.6, diameter of the boss equal to 0.35 times the diameter of the runner and an overall efficiency of 88 percent. Calculate the diameter, speed and specific speed of the turbine. (8)
6. a) What are characteristic curves and what are their uses. Draw the main characteristic and operating characteristics for different types of turbine. (8)
- b) Explain the theory and function of Draft tube. Derive an expression for draft tube efficiency. (8)

Unit - IV

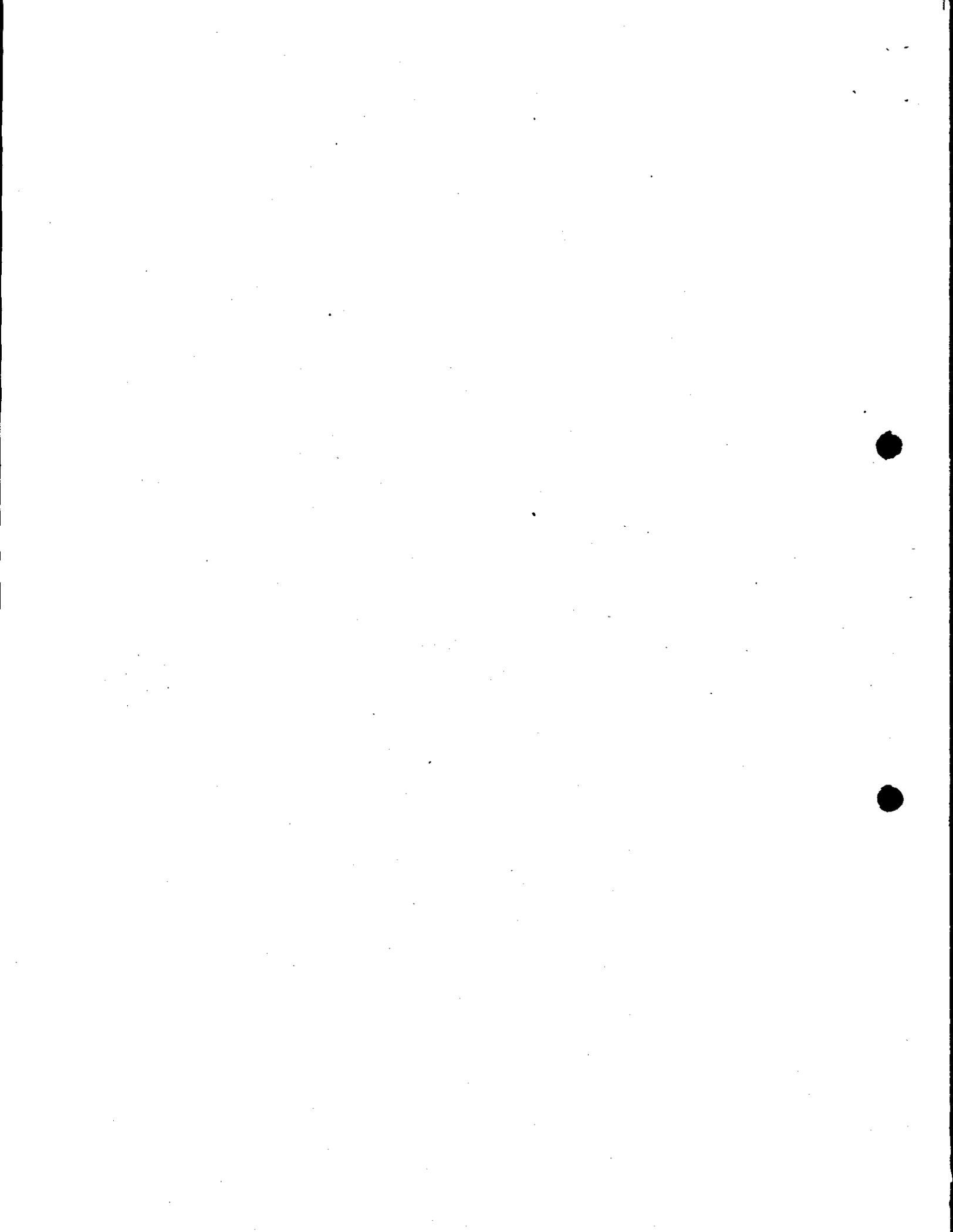
7. a) Obtain an expression for the pressure head due to acceleration on the reaction and delivery pipe for reciprocating pump. (8)
- b) The diameter and stroke length of a single acting reciprocating pump are 75 mm and 150 mm respectively. It takes it supply of water from a sump 3m below the pump through a pipe 5 m long and 40 mm in diameter. It delivers water to a tank 12 m above the pump through a pipe 30 mm in diameter and

15 m long. If separation occurs 75 kN/m^2 below the atmospheric pressure, find the maximum speed at which pump may be operated without separation. Assume that the piston has a simple harmonic motion. (8)

8. Write short notes on any two : (16)
- a) Hydraulic Lift.
 - b) Hydraulic Ram.
 - c) Hydraulic Torque converter.

Unit - V

9. a) Explain the importance of hydrographs and flow duration curve for the installation of Hydro Electric Power Plant. (8)
- b) Write short note on Surge Tank. (8)
10. a) Write note on Hydro Power development in India. (8)
- b) How is the selection of Turbine made. (8)
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6E3052**B.Tech. VIth Semester (Main/Back) Examination, June - 2010****Mechanical Engineering****Noise, Vibration and Harshness****Time : 3 Hours****Maximum Marks : 80****Min. Passing Marks : 24****Instructions to Candidates:**

Attempt any five questions selecting one question from each unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)

Unit - I

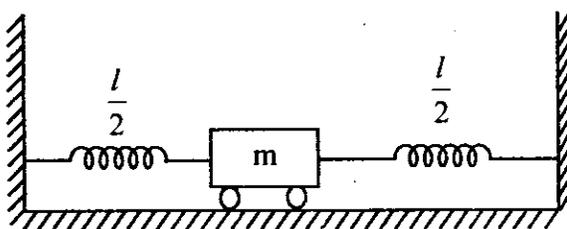
- a) Write a detailed note on subjective response of humans to sound, explaining frequency dependent and sound pressure dependent human response. (8)
b) What is inverse square law? Deduce a relationship between sound power level and sound intensity level. (8)

OR

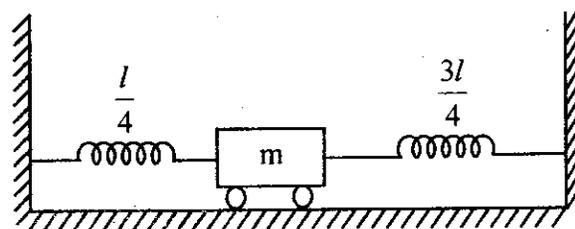
- What are the major industrial noise sources? Explain various strategies used to control the industrial noise. (16)

Unit - II

- a) A helical spring of stiffness k is cut into two halves and a man m is connected to the two halves as shown in figure (i) The natural time period of this system is found to be 0.5 Sec. If an identical spring is cut so that one part is one-fourth and the other part three-fourth of the original length, and the man m is connected to the two parts as shown in figure (ii) What would be the natural period of the system? (8)



(i)



(ii)

- b) Describe the principle of conservation of energy and *D' Alembert's* principle. Derive the equation of motion of spring-mass system using both of these principles. (8)

OR

4. a) Explain the salient characteristics of a coulomb damped system. (8)
- b) A vibrating system is defined by the following parameters.

$$M = 3\text{kg}, k = 100 \text{ N/m}, C = 3\text{N} - \text{sec/m}$$

Determine :

- i) the damping factor / ratio.
- ii) the natural frequency of damped vibrations.
- iii) logarithmic decrement.
- iv) the number of cycles after which the original amplitude is reduced to 20% (8)

Unit - III

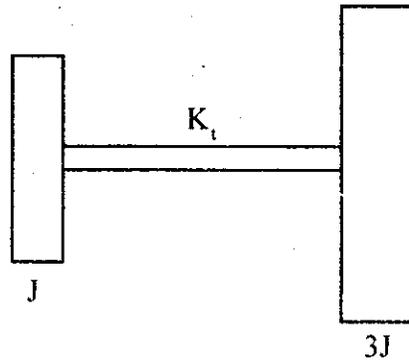
5. a) Derive the expression of displacement transmissibility for a single degree of freedom spring-mass-dashpot system. Subjected to a harmonic excitation of the base. Plot the displacement transmissibility ratio for different amounts of damping against the frequency ratio. (8)
- b) A spring - mass - damper system is subjected to a harmonic force. The amplitude is found to be 20 mm at resonance and 10 mm at a frequency 0.75 times the resonant frequency. Find the damping ratio of the system. (8)

OR

6. a) Write a short note on various materials used in vibration isolation. (8)
- b) Consider a spring-mass-damper system with $k = 4000 \text{ N/m}$, $m = 10 \text{ kg}$, and $c = 40\text{N-sec/m}$. Find the steady state and total response of the system under the harmonic force $F(t) = 200 \cos 20t$ and the initial conditions $x_0 = 0.1 \text{ m}$ and $dx_0/dt = 0$. (8)

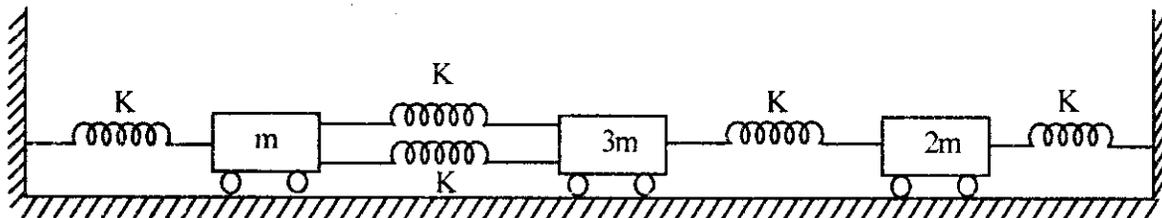
Unit - IV

7. a) Explain the principle and working of centrifugal pendulum absorber. (8)
- b) For the following system derive and determine the equation of motion, natural frequencies of vibration and mode shapes. (8)

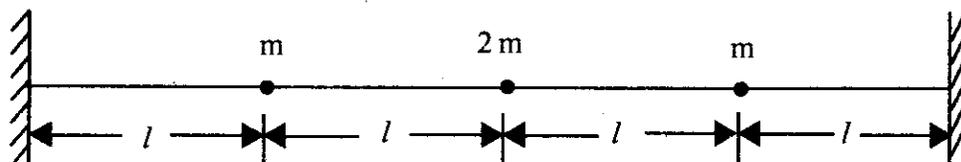


OR

8. a) Draw the free-body diagram of the following many degrees of freedom system and derive the differential equation governing the motion of the system using Newton's law of motion. Also arrange these equation in matrix form. (8)

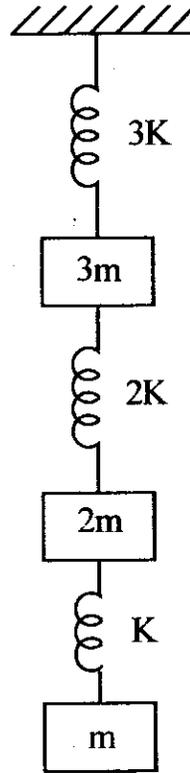


- b) A mass less string is stretched with tension T has three mass points attached at equal intervals as shown in figure. Find the natural frequency and mode shapes of the system. (8)



Unit - V

9. a) Write a short note on Holzer's method and point out advantage and limitations of this method. (8)
- b) Find the lowest natural frequency of the following system using Stodola's method. (8)



OR

10. Derive the equation governing the transverse vibrations of a tightly stretched string. Also find the first four natural frequencies and corresponding mode-shapes for the fixed - fixed end conditions. (16)

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B. Tech. VIth Semester (Main/Back) Examination, June - 2010

Mechanical Engineering

6ME6 Numerical Methods and Applied Statistics

Time : 3 Hours

Maximum Marks : 80

Min. Passing Marks : 24

Instructions to Candidates:

Attempt any five questions selecting one question from each unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)

Unit - I

1. a) Find all root of the equation $x^3 - 2x^2 - 5x + 6 = 0$ by Graeffe's method, squaring thrice.
- b) Find the root of $3x^3 - 7x^2 + 10x - 20 = 0$ by taking $x = 3 + i$

OR

- a) Find the root of the equation $x^3 - 9x + 1 = 0$ between $x = 2$ and $x = 4$ by the method of bisection
- b) Find the real root of the equation $x^3 - 2x - 5 = 0$ using secant method.

Unit - II

2. a) Using Partition method, find the inverse of the matrix $A = \begin{bmatrix} 3 & 2 & 1 \\ 2 & 3 & 2 \\ 1 & 2 & 2 \end{bmatrix}$

- b) Use power method to find the largest eigenvalue and corresponding

eigen vector of the matrix $A = \begin{bmatrix} 1 & 2 & 0 \\ 2 & 1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$.

OR

- a) Obtain the missing terms in the following table :

x	:	1	2	3	4	5	6	7	8
$f(x)$:		1	8	9	64	9	216	343	512

and find $f(7.5)$

- b) Using Newton's divided difference formula, find $f(8)$ and $f(15)$ from the following table

x	:	4	5	7	10	11	13
$f(x)$:		48	100	294	900	1210	2028

Unit - III

3. a) Find first and second derivative at $x = 1.1$ from the following table

x	:	1	1.2	1.4	1.6	1.8	2.0
$f(x)$:		0	0.1280	0.5440	1.2960	2.4320	4.00

- b) Evaluate $\int_2^4 (x^2 + 2x) dx$ by Gauss Quadrature formula.

OR

- a) Given $\frac{dy}{dx} = x^2(1+y)$ and $y(1) = 1$, $y(1.1) = 1.233$, $y(1.2) = 1.548$, $y(1.3) = 1.979$ evaluate $y(1.4)$ by Adams-Bashforth method.

- b) Apply Runge-Kutta method to find the approximate value of y for $x = 0.2$ in step of 0.1 if $\frac{dy}{dx} = x + y^2$, given that $y = 1$ when $x = 0$.

Unit - IV

4. a) The first three moments of a distribution about the value 2 of a variable are 1, 16 and -40. Show that the mean is 3, the variance 15 and $\mu_3 = -86$. Also find the first three moments about $x = 0$.

- b) From a lot of 25 items contains 5 defectives, a sample of 4 items is drawn at random (i) without replacement (ii) with replacement.

Find the expected number of defectives in the sample.

OR

- a) 10% bolt produced by a machine are defective. Find the probability of following when they are checked at random by examining samples of 5:
- a) None is defective
 - b) one is defective
 - c) at most one is defective.
- b) A factory produces razor blades. The probability of its being defective is $\frac{1}{500}$ in 10,000 packets of 10 blades each, calculate the approximate number of packet.
- a) having no defective blade.
 - b) one defective blade.
 - c) two defective blades (Given $e^{-0.02} = 0.9802$).

Unit - V

5. a) Nine patients, to whom a certain drug was administered, registered the following increments in blood pressure:

7,3,-1,4,-3,5,6,-4,1

Show that the data do not indicate that the drug was responsible for these increments. The value of t for 10, 9 and 8 d.f. at 5% level of significance are 2.23, 2.26 and 2.31 respectively.

- b) Two horses A and B were Tested according to the time (in seconds) to run a particular track with the following result :

Horse A : 28 30 32 33 33 29 34

Horse B : 29 30 30 24 27 29

Test whether you can discriminate between the two horses. You can use the fact that 5% value of t for 11 d.t. in 2.20.

OR

- a) Fit a Poisson distribution to the following data and show whether the fit is satisfactory or not :

x_i :	0	1	2	3	4	5	6	7
o_i :	364	376	218	89	33	13	2	1

- b) Ten competitors in a beauty contest got marks by three judges in the following orders :

First Judge : 1 6 5 10 3 2 4 9 7 8

Second Judge : 6 4 9 8 1 2 3 10 5 7

Third Judge : 3 5 8 4 7 10 2 1 6 9

Use rank correlation coefficient to discuss which pair of judges have the nearest approach to common tastes in beauty.

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6E3049**B.Tech. VIth Semester (Main/Back) Examination, June - 2010****Mechanical Engineering****6ME1 Design of M/c Elements-II (Common for Mech., & P.I)****Time : 3 Hours****Maximum Marks : 80****Min. Passing Marks : 24****Instructions to Candidates:**

Attempt any five questions selecting one question from each unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

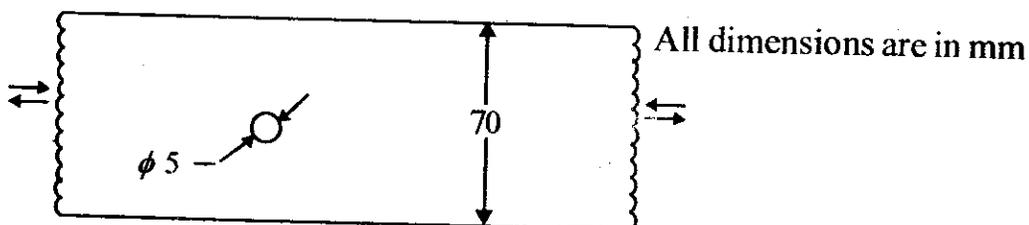
1. Design Data Handbook.

Unit - I

1. a) Discuss influence of size, surface finish and reliability in modifying the Endurance limit. (6)
b) A simply supported shaft of C 40 steel and 1000 mm span carries a central load of 800 kg at the centre of span. The torque varies from 1000 N - m to 2000 N - m. Ignoring stress concentration, determine diameter of shaft using maximum shear stress theory. Take F. O. S = 2. (10)

OR

- a) Discuss methods of mitigation of stress concentration. (6)
b) For a rectangular plate of section 70 mm × 10 mm with a central hole of 5mm, find the value of completely reversed axial load that can be applied for infinite life and 95% reliability. The plate is machined out of C15 steel. Consider the effect of stress concentration and take notch sensitivity as 0.8 and F. O. S = 2. (10)



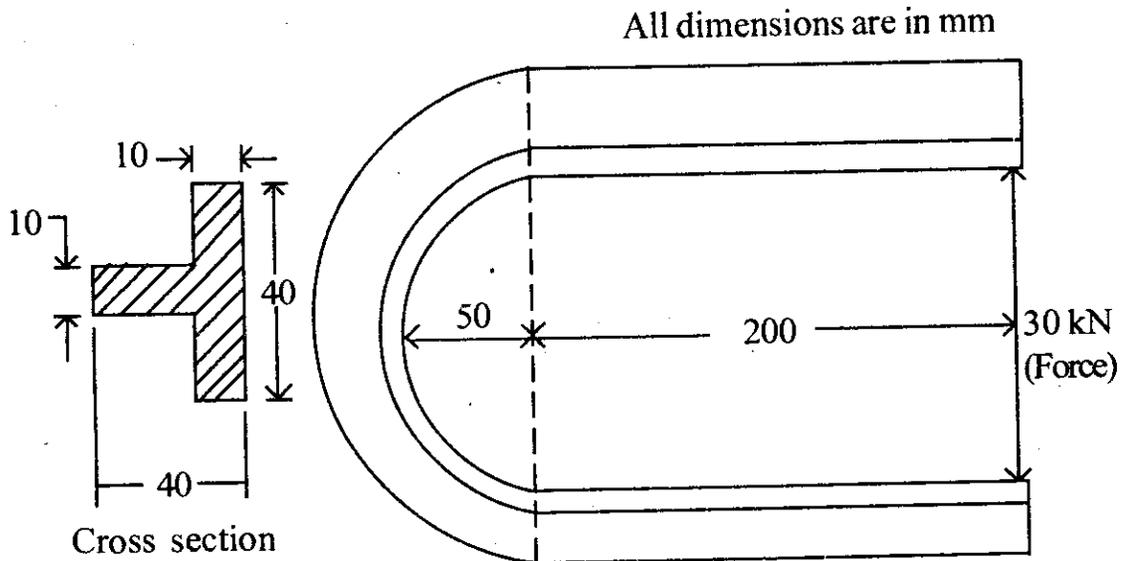
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(1)

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Unit - II

2. a) Discuss preloading of bolts. Further discuss stresses in bolt due to preloading. (6)
- b) Determine maximum value of stress in a C-Clamp as shown below. (10)



OR

- a) Draw and describe various thread forms suitable for power screws. (6)
- b) Design a screw jack to lift 2.5 tonnes by 20 cm. Take C 25 carbon steel for screw, nut and lever. Coefficient of friction for collar and threads is 0.2. Make suitable assumptions wherever needed. (10)

Unit - III

3. a) Draw and describe Chordal action in Chain drive. (6)
- b) Determine width of belt and belt length for the following particulars of a flat belt drive: (10)

Centre distance = 6000 mm, Power = 100 KW.

Pulley diameters = 420 mm and 1680 mm.

Speed of bigger pulley = 240 rpm

Belt thickness = 8 mm of leather

Coefficient of friction $\mu = 0.3$

Material density $e = 0.92 \text{ gm/cm}^3$

Allowable stress in belt = 2.0 N/mm^2 .

OR

- a) Discuss stresses in a helical spring subjected to axial load. (6)
- b) A helical compression spring is made from a wire of 1 mm diameter having yield strength of 720 N/mm². It has mean diameter of 12 mm and there are 14 active coils of spring. Find :
- i) Static load corresponding to yield point
 - ii) Deflection
 - iii) Stiffness
 - iv) Solid height and
 - v) free length.

Take $G = 0.84 \times 10^5$ N/mm² Mention end conditions. (10)

Unit - IV

4. a) List out the assumptions made in Lewis equation for gear design. (6)
- b) Design a 20° spur gear drive to transmit 10 kW from a shaft running at 1440 r.p.m. to another shaft running at 360 r.p.m. Use C 45 for gear and pinion with suitable FOS. (10)

OR

- a) Discuss gear materials and their application. (6)
- b) A helical pair transmits 20 KW with pinion of 20 teeth and 5 module running at 1200 r.p.m. Pressure angle is 20° and helix angle is 25°. Compute
- i) The tangential force
 - ii) The radial force and
 - iii) The axial thrust

Assume suitable positions of gear and pinion and direction of rotation. Accordingly draw a force component diagram. (10)

Unit - V

5. a) Discuss bearing characteristic number. With help of diagram discuss different states of hydrodynamic lubrication. (6)
- b) Design a journal bearing for supporting a generator shaft of 75 mm dia with a load of 12 KN running at 1440 r.p.m. Suitable data may be picked from design hand book. (10)

OR

- a) Discuss the types of antifriction bearings and their application. (5)
- b) Draw and discuss pressure distribution diagrams for a hydrodynamic journal bearing. (5)
- c) Select a suitable anti friction bearing for a radial load of 2000 N with operation at 1200 r.p.m. for 2200 hours. Assume the axial load, if any, to be negligible. (6)
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