CBCS SCHEME

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15ME51

Fifth Semester B.E. Degree Examination, June/July 2019
Management and Engineering Economics

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of Interest Factor table permitted.

Module-1

1 a. Define Management. Give a brief account of the nature of management. **(04 Marks)**
b. Explain the various functions of management. **(12 Marks)**

OR

2 a. Mention the differences between strategic planning and tactical planning. **(04 Marks)**
b. Explain the various steps of planning. **(12 Marks)**

Module-2

3 a. What is an organization? Explain the types of organization. **(08 Marks)**
b. Briefly explain the essential of sound controlling. **(08 Marks)**

OR

4 a. Explain the shaft selection process in an organization. What is MBO and MBE? **(08 Marks)**
b. Define leadership. What are the basic styles of leadership? Explain each in brief. **(08 Marks)**

Module-3

5 a. Explain the problem solving process in decision making. **(06 Marks)**
b. Explain the laws of demand and supply with an example. **(06 Marks)**
c. Explain elasticity of demand with an example. **(04 Marks)**

OR

6 a. Explain the law of returns. **(08 Marks)**
b. Determine the effective rate of interest for a nominal annual rate of 6 percent that is compounded :
(i) Semiannually (ii) quarterly (iii) monthly (iv) daily **(08 Marks)**

Module-4

7 a. The following alternatives are available for an objective.

	Plan A	Plan B	Plan C
Life cycle	6 years	3 years	4 years
First cost (Rs.)	2000	8000	10000
Annual cost (Rs.)	3200	700	500

Compare the present worth of the alternatives using an interest rate of 7% p.a. **(12 Marks)**
b. The rights to a patent have been sold under an agreement in which annual year end payments of Rs.1,00,000 are to be made for the next 10 years. What is the present worth of the agreement at an interest rate of 7%? **(04 Marks)**

OR

8 a. Two models of small machines perform the same function. Type I machine has a low initial cost of Rs. 95,000 and a relatively high operating cost of Rs. 19,000 per year, has a short life of 4 years. The more expensive Type II machine costs Rs. 2,50,000. With an operating cost of Rs. 8000 per year and has a life of 8 years. Which machine is preferred when the MARR is 8%. Use equivalent cost method. **(08 Marks)**

b. A company is currently renting a parking lot for employees and visitors and visitors use at an annual cost of Rs.9000, payable on the first of each year. The company has an opportunity to buy the lot for Rs. 50,000. Maintenance and taxes on the property are expected to cost Rs.2500 annually. Given that the property will be needed for 10 more years, determine what sales price must be obtained at the end of the period in order for the company to break even, when the interest rate is 12%. **(08 Marks)**

Module-5

9 a. Explain briefly the standard cost and marginal cost. **(04 Marks)**

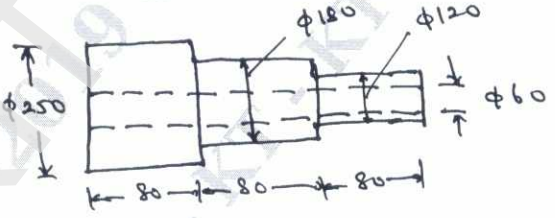
b. Explain the importance of estimating and costing. **(04 Marks)**

c. A factory produce CFL tubes in batches of 1000. The direct material cost for a batch is Rs.1600 and direct labour cost is Rs.2000. The factory overhead is 32 percent of material and labour costs. Selling and distribution costs are 20 percent of factory cost. If the management wants to make a profit of 20 percent on gross cost, determine the selling price of each tube. **(08 Marks)**

OR

10 a. A company purchases a motor cycle for its sales person at a cost of Rs.80,000 and plans to replace it at the end of 5 years. The salvage value expected is Rs. 30,000. Determine the depreciation amount and the book value at the end of each year by (i) Straight line method, (ii) Sum of years method (iii) Double declining balance method. Tabulate the values. **(12 Marks)**

b. A cost iron stepped cone pulley is shown in Fig.Q10(b). Calculate the material cost, it the density is cast iron is 7.209 gm/cc and the cost is Rs. 20/kg. **(04 Marks)**



All dimensions in mm
Fig.Q10(b)

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15ME52

Fifth Semester B.E. Degree Examination, June/July 2019
Dynamics of Machinery

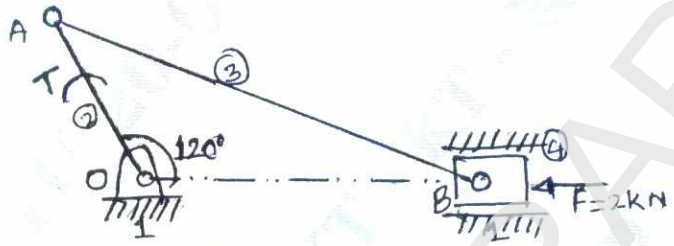
Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. State the condition of equilibrium of a body subjected to a system of (i) two forces, (ii) three forces and (iii) member with two forces and a torque. **(06 Marks)**

b. A slider crank mechanism with the following dimensions is acted upon by a force, F = 2 kN at B as shown in Fig.Q1(b). Determine the input torque 'T' on the link OA for the static equilibrium of the mechanism.



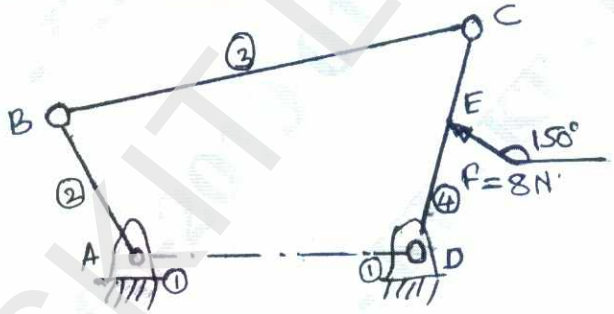
OA = 100 mm
AB = 450 mm

Fig.Q1(b) **(10 Marks)**

OR

2 a. Explain the principle of virtual work. **(06 Marks)**

b. A four link mechanism with the following dimensions is acted upon by a force 80 N at 150° on link DC as shown in Fig.Q2(b). Determine the input torque T on the link AB for the static equilibrium of the mechanism.



AD = 500 mm
AB = 400 mm
BC = 1000 mm
DC = 750 mm
DE = 350 mm

Fig.Q2(b) **(10 Marks)**

Module-2

3 a. Explain static and dynamic balancing of rotating masses. **(04 Marks)**

b. Four masses A, B, C and D carried on a shaft at radii 100 mm, 125 mm, 200 mm and 150 mm respectively. The planes at which these masses are rotating are placed 600 mm apart. The mass B, C and D are 10 kg, 5 kg and 4 kg respectively. Find the mass of A and relative angular positions of the four masses so that the shaft will be in equilibrium. **(12 Marks)**

OR

4 a. Explain partial balancing in reciprocating masses. **(04 Marks)**

b. The successive cranks of a five cylinder inline engine are at 144° apart. The spacing between cylinder centre lines is 400 mm. The lengths of the crank and connecting rod are 100 mm and 450 mm respectively. The reciprocating mass for each cylinder is 20 kg. The engine speed is 630 rpm. Determine the maximum values of primary forces and couples. **(12 Marks)**

Module-3

5 a. Define the following with respect to the working of governors:

i) Sensitiveness
ii) Isochromism
iii) Effort of a governor
iv) Stability of governor **(08 Marks)**

b. Each arm of a porter governor is 200 mm long and is pivoted on the axis of governor. The radii of the balls at the minimum and maximum speeds are 120 mm and 160 mm respectively. The mass of the Sleeve is 24 kg and each ball is 4 kg. Find the range of speed of the governor. Also find the range of speed if the friction at the sleeve is 18 N. **(08 Marks)**

OR

6 a. Derive an expression for gyroscopic couple C = IWWp. **(06 Marks)**

b. An aeroplane flying at 240 km/hr turn towards left and completes a quarter circle of radius 60 m. The mass of the rotary engine and propeller plane is 450 kg with a radius of gyration of 320 mm. the engine speed is 2000 rpm clock wise when viewed from the rear. Determine the gyroscopic couple and state its effect. In what way the effect is changed when the aeroplane turns towards right. **(10 Marks)**

Module-4

7 a. Explain different types of vibrations with sketches. **(06 Marks)**

b. Derive an expression for the natural frequency of spring-mass system using Newton's method and energy method. **(10 Marks)**

OR

8 a. Define vibration. What are the causes of vibrations? Mention remedies for vibrations. **(05 Marks)**

b. Neglecting the mass of the rod, determine the natural frequency of the system shown in Fig.Q8(b).

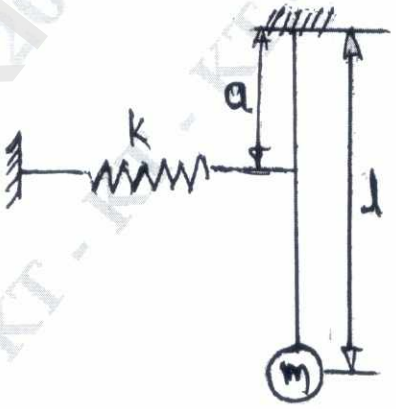


Fig.Q8(b) **(06 Marks)**

c. A mass is suspended from a spring as shown in Fig.Q8(c). Determine the natural frequency of the system.

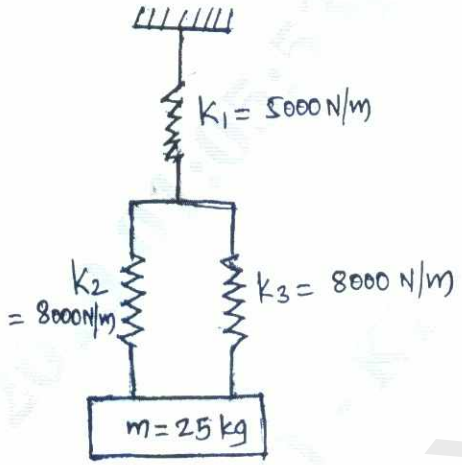


Fig.Q8(c) **(05 Marks)**

Module-5

9 a. List different type of damping. Explain any two type of damping. **(06 Marks)**

b. Determine:

i) The critical damping coefficient

ii) The damping factor

iii) The natural frequency of damping vibrations

iv) The logarithmic decrement

v) The ratio of two consecutive amplitudes of a vibrating system which consists of a mass of 25 kg, a spring stiffness 15 kN/m and a damper. The damping provided is 15% of the critical value. **(10 Marks)**

OR

10 a. What is magnification factor? Explain. **(05 Marks)**

b. Explain the terms vibration isolation and transmissibility ratio. **(04 Marks)**

c. The support of a spring-mass system is vibrating with an amplitude of 5 mm and a frequency of 1150 cycle/min. If the mass is 0.9 kg and the spring has a stiffness of 1960 N/m, determine the amplitude of vibration of the mass. What amplitude will result if a damping factor of 0.2 is included in the system? **(07 Marks)**

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15ME53

Fifth Semester B.E. Degree Examination, June/July 2019
Turbo Machines

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. List the difference between positive displacement machine and turbo machine. **(08 Marks)**

b. Two geometrically similar pumps are running at same speed of 1000 rpm. One pump has an impeller diameter of 0.3 m and lifts water at the rate of 20 litres/sec against a head of 15 m. Determine the head and impeller diameter of the other pump to deliver half the discharge. **(08 Marks)**

OR

2 a. Derive the equation of efficiency η_p for compression process

$$\eta_{cs-s} = \frac{(Pr)^{\frac{\gamma-1}{\gamma}} - 1}{(Pr)^{\frac{\epsilon}{\eta_p}} - 1}$$ **(08 Marks)**

b. A turbine has four stages and each stage pressure ratio is 2. The inlet static temperature is 630°C. The mass flow rate is 30 kg/s. the overall efficiency is 0.8. Calculate: (i) the polytropic efficiency (ii) stage efficiency (iii) the power developed (iv) the reheat factor. **(08 Marks)**

Module-2

3 a. Derive the alternate forms of Euler's turbine equation and explain the significance of each energy component. **(08 Marks)**

b. In an axial flow turbine discharge blade angles are 20° each for both stator and rotor. The steam speed at the exit of fixed blade is 150 m/s. The ration $\frac{V_{ax}}{U} = 0.75$ at exit of rotor. Find the inlet blade rotor angle, power developed and degree of reaction for a flow rate of 3.5 kg/s. **(08 Marks)**

OR

4 a. Derive an expression of theoretical head capacity relationship of radial outward flow devices for different values of discharge angles (centrifugal machines). **(08 Marks)**

b. An inward flow reaction turbine has outer and inner diameter wheels as 1 m and 0.5 m respectively. The vanes are radial at inlet and discharge is radial at outlet and fluid enters the vanes at an angle of 10°. Assuming the velocity of flow to be constant and equal to 3 m/s. Find: (i) speed of wheel (ii) vane angle at outlet (iii) degree of reaction. **(08 Marks)**

Module-3

5 a. What is the necessity for compounding steam turbines? Name the different compounding methods and explain any one. **(08 Marks)**

b. In a single stage impulse turbine the mean diameter of the blades is 1m. It runs at 3000 rpm. The steam is supplied from a nozzle at a velocity of 350 m/s and nozzle angle is 20°. The rotor blades are equiangular. The blade friction factor is 0.86. Draw the velocity diagram and calculate the power developed if the axial thrust is 117.72 Newton's. **(08 Marks)**

OR

6 a. For a 50% reaction steam turbine, show that $\alpha_1 = \beta_2$ and $\alpha_2 = \beta_1$, where α_1 and β_1 are the inlet angles of fixed and moving blades, α_2 and β_2 are the outlet blade angles of fixed and moving blade angles. **(08 Marks)**

b. In a reaction turbine, the inlet and outlet blade angles are 50° and 20° respectively. Steam enters at 18° to the plane of the rotor wheel and leaves at 40°. The rotor speed is 260 m/s. Calculate the speed ratio, specific work and degree of reaction. **(08 Marks)**

Module-4

7 a. Show that the maximum hydraulic efficiency of a Pelton wheel turbine is given by $(\eta_h)_{max} = \frac{1+c_b \cos\beta_2}{2}$. Also draw the inlet and exit velocity triangles, c_b is bucket velocity coefficient and β_2 is exit blade angle. **(08 Marks)**

b. The penstock supplies water from a reservoir to the Pelton wheel with a gross head of 500 m. One third of the gross head is lost in friction in the penstock. The rate of flow of water through the nozzle fitted at the end of penstock is 2 m3/s. The angle of deflection of the jet is 165°. Determine the power given by the water to the runner and also hydraulic efficiency of the Pelton wheel. Take speed ratio = 0.45 and $c_v = 1.0$. **(08 Marks)**

OR

8 a. The following data are given for a Francis turbine net head = 70 m, speed = 600 rpm, power at the shaft = 367.5 KW, overall efficiency = 85%, hydraulic efficiency = 95%, flow ratio = 0.25, width ratio = 0.1, outer dia to inner dia ratio = 2. The thickness of the vanes occupy 10% of the circumferential area of the runner. Velocity of flow is constant at inlet and outlet and discharge is radial at outlet. Determine: (i) Guide blade angle (ii) Runner vane angles (iii) Diameter of runner at inlet and outlet (iv) Width of wheel at inlet. **(08 Marks)**

b. With a neat sketch, explain the working of Kaplan turbine. Mention the functions of draft tube. **(08 Marks)**

Module-5

9 a. Explain the following with reference to centrifugal pump:
i) Manometric efficiency with expression
ii) Cavitation in pump
iii) Need of priming
iv) Pumps in series **(08 Marks)**

b. A centrifugal pump is designed to run at 1450 rpm with maximum discharge of 1800 litres/min against a total read of 20 m. The suction and delivery pipes are designed such that they are equal in size of 100 mm. If the inner and outer diameter of the impeller are 12 cm and 24 cm respectively, determine the blade angles β_1 and β_2 for radial entry. Neglect friction and other losses. **(08 Marks)**

OR

10 a. Explain the phenomena of slip factor, surging, stalling and chocking in centrifugal compressor. **(08 Marks)**

b. Air enters a three stage axial flow compressor at 1 bar and 300 K. the energy input is 25 kJ/kg per stage. The stage efficiency is 0.86. Calculate: (i) the exit static temperature (ii) the compressor efficiency (iii) the static pressure ratio. **(08 Marks)**

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15ME54

Fifth Semester B.E. Degree Examination, June/July 2019
Design of Machine Elements – I

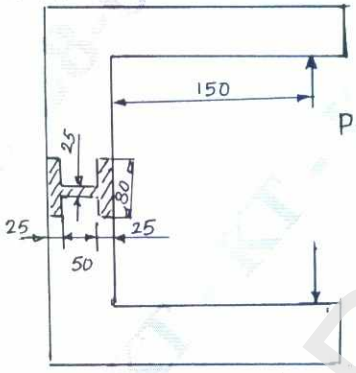
Time: 3 hrs. Max. Marks: 80

Note: 1. *Answer any FIVE full questions, choosing ONE full question from each module.*
2. *Use of design data hand book is permitted.*
3. *Assume missing data, if any, suitably.*

Module-1

1 a. Briefly discuss the factors influencing the selection of suitable material for machine elements. **(04 Marks)**

b. Determine the extreme fibre stresses at the critical section of the machine member loaded as shown in Fig.Q1(b). Also show the distribution of stresses at this section. **(12 Marks)**



All dimensions are in mm.

Fig.Q1(b)

OR

2 a. Give any three examples of stress raisers and show how the stress concentration can be reduced in these cases. **(06 Marks)**

b. A machine element loaded as shown in Fig.Q2(b). Determine the safe value of thickness of the plate. Material selected for the machine element has an allowable stress of 200 MPa.

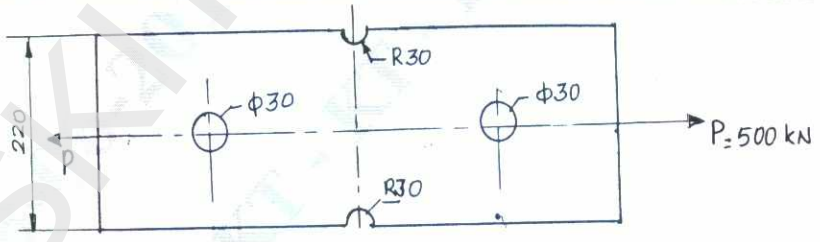


Fig.Q2(b) **(10 Marks)**

Module-2

3 a. Derive an expression for impact stress in a axial bar of c/s A and length 'L' due to the impact load of 'W' falling from a height 'h' from the collar. **(06 Marks)**

b. A steel cantilever beam of rectangular cross section is loaded 400 mm from the support. The width of the beam is 15 mm and depth is 20 mm. Determine the max bending stress in the beam, when a weight of 100 N is dropped on the beam through a height of 5 mm. Take E = 210 N/mm^2. **(06 Marks)**

c. Explain with neat sketches, the different types of varying stresses. **(04 Marks)**

OR

4 a. Derive Soderberg's design equation for members subjected to variable stresses. **(06 Marks)**

b. A hot rolled steel shaft is subjected to a torsional load varies from 330 Nm clockwise to 110 Nm counter, clockwise and an applied bending moment varies from +440 Nm to –220 Nm. Determine the required shaft diameter. The ultimate strength of the material is 550 MPa and yield stress is 410 MPa. Take factor of safety as 1.5, endurance limit as half the ultimate strength and size factor as 0.85. Neglect the effect of stress concentration. **(10 Marks)**

Module-3

5 A steel shaft (C45) transmitting 15 kW at 210 rpm is supported between two bearings 1000 mm apart. On this, two spur gears are mounted. The gear having 80 teeth of module 6 mm is located 100 mm to the left of the right bearing and receives power from a driving gear such that the tangential force acts vertical. The pinion having 24 teeth and 6 mm module located 200 mm to the right of the left bearing and delivers power to a gear mounted behind it. Taking combined shock and fatigue factors 1.75 in bending and 1.25 in torsion, determine the diameter of the shaft. **(16 Marks)**

OR

6 a. Design a socket and spigot type of cotter joint for an axial load of 50 kN which alternately changes from tensile to compressive, assuming allowable stresses in the components under tension and compression as 52.5 MPa, bearing stress as 63 MPa and shearing stress as 35 MPa. **(08 Marks)**

b. Design a protected type cast-iron flange coupling for a steel shaft transmitting 30 kW at 200 rpm. The allowable shear stress in the shaft and key material is 40 MPa. The maximum torque transmitted is 20% greater than the full load torque. The allowable shear stress in the bolt is 60 MPa and allowable shear stress in the flange is 40 MPa. **(08 Marks)**

Module-4

7 a. Design a double riveted butt joint to connect two plates of 20 mm thick. The joint is zig-zag riveted and has equal width cover plates. The allowable tensile stress for the plate is 100 MPa. The allowable shear and crushing stresses for rivet material are 60 MPa and 120 MPa respectively. Calculate the efficiency of the joint so that the joint should be leak proof. **(08 Marks)**

b. Determine the size of rivets required for the bracket shown in Fig.Q7(b). Take permissible shear stress for the rivet material as 100 MPa.

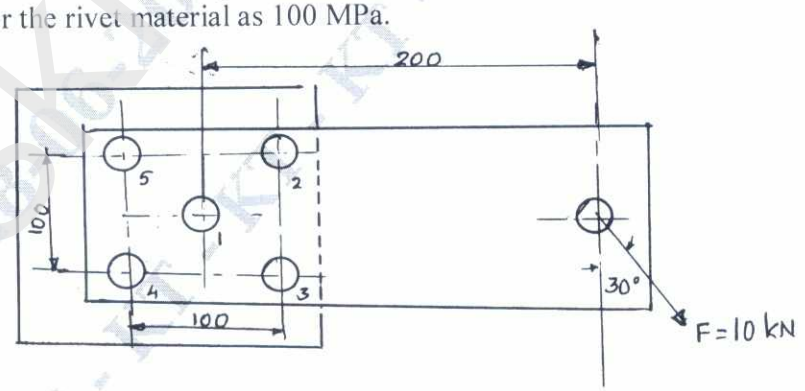


Fig.Q7(b) **(08 Marks)**

OR

8 a. A steel plate is welded by fillet weds to a structure and is loaded as shown in Fig.Q8(a). Calculate the size of the weld, if the load is 35 kN and allowable shear stress for the weld material is 90 MPa.

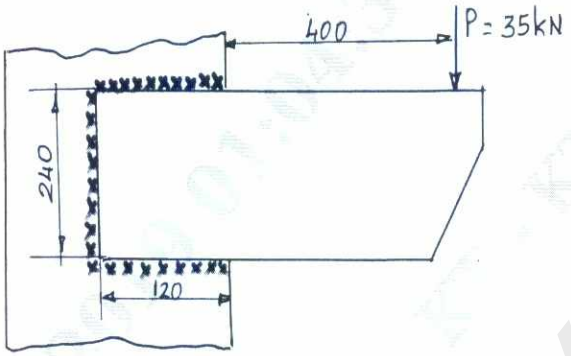


Fig.Q8(a) **(08 Marks)**

b. A circular beam, 50 mm in diameter is welded to a support by means of a fillet weld as shown in Fig.Q8(b). Determine the size of the weld, if the permissible shear stress in the weld is limited to 100 N/mm^2.

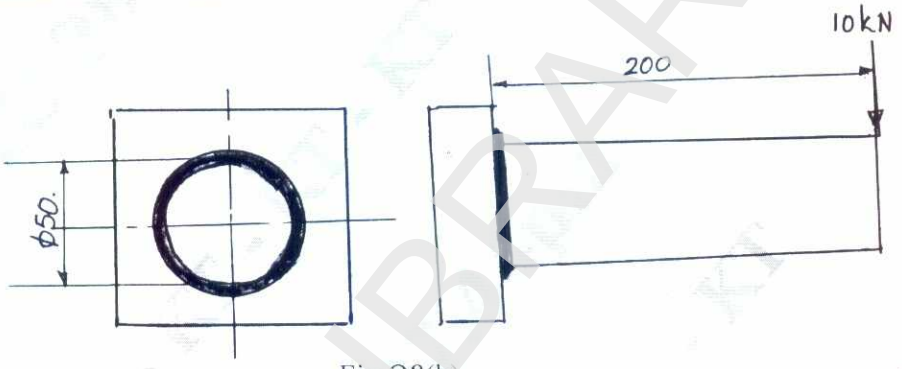


Fig.Q8(b) **(08 Marks)**

Module-5

9 a. Explain various types of stresses in threaded fasteners. **(04 Marks)**

b. A cylinder head is fastened to the cylinder of a compressor using 6 bolts of M20 size. Bolt material is C20 steel. The maximum fluid pressure is 3.5 MPa, cylinder diameter is 75 mm. A soft gasket is used. Assuming initial tension in each bolt is 40 kN, determine the factor of safety. **(12 Marks)**

OR

10 a. Derive an expression for torque required to lift the load on a square threaded screws. **(06 Marks)**

b. A square threaded power screw has a nominal diameter of 30 mm and a pitch of 6 mm with double start. Load on the screw is 6 kN and the mean diameter of the thrust collar is 40 mm. The coefficient of friction for screw is 0.1 and for collar is 0.09. Determine:

i) Torque required to rotate the screw against the load.
ii) Torque required to rotate the screw with the load.
iii) Overall efficiency.
iv) Is the screw self-locking? **(10 Marks)**

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