CBCS SCHEME

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17ME51

Fifth Semester B.E. Degree Examination, June/July 2023
Management & Engineering Economics

Time: 3 hrs. Max. Marks: 100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Define Management. Give nature and characteristics of management. **(12 Marks)**
b. Discuss management as a Science, Art or Profession. **(08 Marks)**

OR

2 a. State the importance of planning. **(08 Marks)**
b. Explain Decision making, with block diagram. Explain any two points in steps. **(12 Marks)**

Module-2

3 a. What are the different principles of an organization? **(08 Marks)**
b. Explain in detail block diagram of functional organization. **(12 Marks)**

OR

4 a. Explain any two selection techniques. **(06 Marks)**
b. Explain briefly motivation and characteristics of motivation in detail. **(14 Marks)**

Module-3

5 a. With a neat sketch, explain briefly problem solving and decision making. **(10 Marks)**
b. Briefly discuss about micro and macro economics. Explain Demand and Supply. **(10 Marks)**

OR

6 a. HDFC bank is offering a Rs.40,00,000/- home loan to a person to buy a new apartment at a interest rate of 6.5% compounded annually. This amount should be repaid in 12 yearly equal installments. Find the Annual installment amount the person has to pay to the bank. **(10 Marks)**
b. A person wishes to have a future sum of Rs. 15 lakhs for his son's engineering education 8 years from now, what is the single payment that he should deposit now so that he gets the desired amount after 8 years? The Bank gives 6% rate of interest compounded annually. **(10 Marks)**

Module-4

7 a. State the procedure for present worth comparison calculation. **(08 Marks)**
b. A CNC machine in a new locality with initial outlay of Rs.95000/- yields Rs.70,000/- during 1st year of its operations and the yield increased by Rs.15000/- from its second year upto 8th year of operations. At the end of the life of business, the machine becomes scrap and has zero salvage value. Find the present worth of the business assuming a Rate of interest of 13% compounded annually. **(12 Marks)**

OR

8 a. Define the following terms :
(i) IRR
(ii) ERR
(iii) MARR
What are the clauses of IRR calculations? **(10 Marks)**

b. A farm home can be purchased for Rs.80,000 and the expected resale value after 20 years is Rs.50,000/-. If the annual rental income is Rs.15,000/- and the expenses Rs.8,000/-. What will be the rate of return earned on this farm home? **(10 Marks)**

Module-5

9 a. Briefly explain the procedure Straight Line (SL) method and Sinking Fund (SF) method. **(10 Marks)**

b. Explain various Tax concepts you know. **(10 Marks)**

OR

10 a. KFC shop employed 75 workers in a particular month to work in the outlets as well as home delivery. The following are the details of expenditure.
(i) Cost of material = Rs.90,000/-
(ii) Rate of wages for each workers = Rs.30/- hr of normal duty, Rs.50/-hr of overtime duty.
(iii) Man hr/day normal duty = 10 hrs
(iv) Number of holidays/month = 7 days
(v) Total overhead expenses = Rs.30,000/-
(vi) Total overtime availed by workers = 270 hrs
(vii) Profit = 25% of the total cost **(10 Marks)**

b. The catalogue price of a Dell laptop is Rs.10,500 and the commission allowed to the proprietor of the show room is 30%. The Administrative and the selling expenses are 70% of the factory cost and the material cost, labour cost and factory overload are in the Ratio 2 : 3 : 1. If the cost of the labour on the manufacturer of machine is Rs.2500/- determine the profit on each Dell laptop. **(10 Marks)**

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17ME52

Fifth Semester B.E. Degree Examination, June/July 2023
Dynamics of Machinery

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 A slider crank mechanism is shown in Fig.Q.1. The force applied to the piston is 1000N when the crank is at 60° from IDC. Calculate the driving torque T_2.

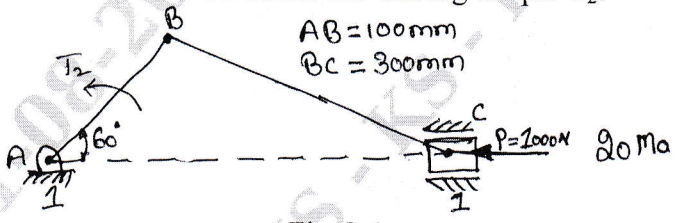

Fig.Q.1

(20 Marks)

OR

2 a. When the crank is 45° from the inner dead centre on the down stroke, the effective steam pressure on the piston of a vertical steam engine is 2.5 bar. The diameter of the cylinder = 0.75n, stroke of the piston = 0.50m and length of connecting rod = 1m. Determine the torque on the crank shaft, if the engine runs at 350rpm and the mass of reciprocating parts is 200kg. **(10 Marks)**

b. A vertical double acting steam engine has a cylinder 300mm diameter and 450mm stroke and runs at 200rpm. The reciprocating parts has a man of 225kg and the piston rod in 50mm diameter. The connection rod is 1.2m long. When the crank has turned through 125° from the top dead centre. The steam pressure above the piston is 30kN/m^2 and below the piston is 1.5kN/m^2. Calculate the effective turnery moment on the crank shaft. **(10 Marks)**

Module-2

3 A shaft carrier four masses A, B, C and D placed in parallel planes perpendicular to the shaft axis and in this order along the shaft. The masses B and C are 40kg and 28kg and both are at 160mm radius. While the masses in planes A and D are at 200mm radius. Angle between B and C is 100°, B and A is 190°, both angles being measured in the same sense. Plane A and B one 250mm apart, B and C are 500mm apart. If the shaft is to be in complete balance, determine i) Masses in planes A and D ii) Distance between planes C and D iii) Angular parities of mass D. **(20 Marks)**

OR

4 The firing order in a 6 cylinder vertical 4 stroke in line engine is 1 – 4 – 2 – 6 – 3 – 5, the piston stroke is 100mm. Length of each connecting rod = 200mm. the pitch distance between cylinder centerlines are 100mm 100mm, 150mm, 100mm and 100mm. Determine the out of balance primary and secondary forces and coupler on thin engine taking a plane midway between cylinder 3 and 4 as reference plane. The reciprocating mass per cylinder is 2kg and the engine runs at 1500rpm. **(20 Marks)**

Module-3

5 a. A porter governor has all four arms 300mm long the upper arms one pivoted on the axis of rotation and lower arms are attached to the sleeve at a distance 35mm from axis. The mass of each ball is 7kg and the load on the sleeve is 540N. Determine the equilibrium speed for the two extreme radii of 200mm and 260mm of rotation of governor balls. **(10 Marks)**

b. A porter governor has arms 250mm long, each one pivoted on the axis of rotation. Mass of each governor ball in 2kg. At the mean speed of 200rpm, it is found that centrifugal force exerted at each ball is 100N. Neglecting friction, determine the central load if the sleeve movement is restricted to ± 20mm. Also, determine the range of speed. **(10 Marks)**

OR

6 a. Explain with a neat sketches, the effect of gyroscopic effect on aeroplane. **(10 Marks)**

b. A ship in pitching through a total angle of 15°, the oscillation may be taken as SHM and the complete period has 32 seconds. The turbine rotor has a mass of 500kg and its radius of gyration is 450mm and it is rotation at 2000rpm. Calculate the maximum value of gyroscopic couple set up. If the rotor in turning clock wise when seeing from the front (bow). How does the bow turn when falling? What is the maximum angular acceleration to which the ship in subject while pitching. **(10 Marks)**

Module-4

7 a. Add the following harmonic motion analytically and check the solution graphically: $x_1(t) = 10\cos wt$ $x_2(t) = 15(\cos wt + 2)$. **(10 Marks)**

b. Add the following two simple harmonic motions and check it graphically:

$$x_1 = 4\sin\left(wt + \frac{\pi}{3}\right) : x_2 = -6\cos\left(wt + \frac{2\pi}{3}\right).$$ **(10 Marks)**

OR

8 a. Determine the natural frequency for a semicircular homogeneous disk of radius R and mass M shown in Fig.Q.8(a) by i) Newton's method ii) Energy method.

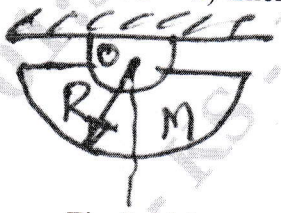

Fig.Q.8(a)

b. Determine the natural frequency of the system shown in Fig.Q.8(b) by i) Newton's methods ii) Energy method. **(10 Marks)**

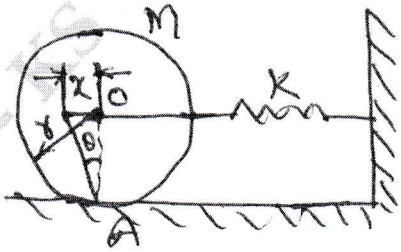

Fig.Q.8(b)

(10 Marks)

Module-5

9 a. A spring mass dashpot system consists of a spring of stiffness 343N/m. The mass in 3.43kg. The mass is displaced 20mm beyond the equilibrium position and released. Find the equation of motion for the system, if the damping coefficient of the dashpot is 13.72N.sec/m. **(10 Marks)**

b. A mass of 7.5kg hinge from a spring and makes damped oscillating. The time for 60 oscillations is 35 sec and the ratio of first to seventh displacement is fond to be 2.5. Find: i) Stiffness of spring ii) Damping resistance iii) If the oscillations were critically damped what in the damping resistance. **(10 Marks)**

OR

10 a. A machine of total mass 200kg is supported on springs of total stiffness 16,000N/cm has an unbalanced rotating element. Which results in a disturbing force 800N at a speed of 300rpm. Assuming $\xi = 0.2$. Determine: i) Amplitude of motion due to unbalance ii) Transmibility iii) Transmitted force. **(10 Marks)**

b. Show that providing damping in vibration isolation is not useful when the frequency ratio is more than 1.414 @ $\sqrt{2}$. **(10 Marks)**

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17ME53

Fifth Semester B.E. Degree Examination, June/July 2023
Turbomachines

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define and give the significance of the specific speed, head coefficient and power coefficient with respect to turbomachines. **(08 Marks)**

b. Explain the effect of Reynold number on the performance analysis of turbomachines. **(04 Marks)**

c. A quarter scale turbine model is tested under a head of 10m. The full scale turbine is required to work under a head of 28.5 m and 415 rpm:
(i) At what speed must the model be run if it develops 94 KW and uses 0.96 m^3/sec at this speed.
(ii) What power will be obtained from the full scale turbine?
(iii) Name the type of turbine. **(08 Marks)**

OR

2 a. Define: (i) Polytropic efficiency (ii) Stage efficiency (iii) Overall efficiency related to compression process. Obtain expressions relating the above efficiencies. **(10 Marks)**

b. A multistage axial flow compressor has equal pressure ratio for each of its stages and is equal to 1.35. The slow rate through the compressor and its overall efficiency are 50 kg/sec and 0.82 respectively. If the conditions of air at the entry are 1.0 bar and 300 K and temperature at the exit of the compressor is 660 K, determine:
(i) The number of stages
(ii) Polytropic efficiency
(iii) Efficiency of each stage
(iv) Power required to drive the compressor assuming the transmission efficiency of 90%. **(10 Marks)**

Module-2

3 a. With the help of inlet and outlet velocity triangles of a general turbomachine, derive the alternate form of Euler turbine equation and identify the components of energy transfer. **(10 Marks)**

b. The steam issues from the nozzle inclined at 28° to the wheel plane with a velocity of 450 m/sec. The mean rotor blade speed of an axial flow turbine stage with a degree of reaction of 50% is 200 m/sec. Ascending symmetrical inlet and outlet velocity triangles, find: (i) rotor blade angle (ii) utilization factor (iii) energy transfer per kg. **(10 Marks)**

OR

4 a. A radial outward flow turbomachine has no inlet whirl. The blade speed at exit is twice that at inlet. The radial velocity is constant throughout, taking the blade angle as 45°, show that degree of reaction is $R = \frac{2 + \cot\beta_2}{4}$ where β_2 = blade angle at exit with respect to tangential direction. Discuss the effect of blade discharge angle. **(10 Marks)**

b. Water enters the mixed flow pump axially and leaves radially so that radial component at inlet and axial component at outlet both are zero. At the inlet, the tangential and axial component each are 16 units and 17 units. At the rotor exit, the radial and tangential components of the absolute velocity are 13 m/sec and 25 m/sec respectively. The tangential blade speed at inlet and exit are 12 m/sec and 47 m/sec respectively. Calculate:
(i) Change in enthalpy across rotor.
(ii) Changes in total pressure
(iii) Change in static pressure
(iv) Degree of reaction R **(10 Marks)**

Module-3

5 a. What is need for compounding in steam turbines? Explain with the help of schematic diagram, the velocity compounding of steam turbine. **(08 Marks)**

b. Steam flows through the nozzle with a velocity of 450 m/s at a direction which is inclined at an angle of 16° to wheel tangent. Steam comes out of the moving blades with a velocity of 100 m/sec in the direction of 110° with the direction of blade motion. The blades are equiangular and the steam flow rate is 10 kg/sec, find:
(i) Power developed (ii) The power loss due to friction (iii) Axial thrust
(iv) Blade efficiency (v) Blade coefficient **(12 Marks)**

OR

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

b. A stage of a turbine with persons blading delivers dry saturated steam at 2.7 bar ($V_s = 0.67\ m^3/kg$) from the fixed blades at 90 m/sec. The mean blade height is 40 mm and the moving blade exit angle is 20°. The axial velocity of steam is ¾ of the blade velocity at the mean radius. Steam is supplied to the stage at the rate of 9000 kg/hr. The effect of blade thickness on the annular area can be neglected. Calculate:
(i) Wheel speed
(ii) The diagram efficiency
(iii) The diagram power
(iv) Enthalpy drop of the steam in this stage **(12 Marks)**

Module-4

7 a. Derive an expression for the hydraulic efficiency of a pelton wheel turbine in terms of jet velocity v_1, blade velocity, u and blade angles. **(10 Marks)**

b. A pelton wheel has a tangential velocity of buckets as 40 m/sec. The water is supplied under a head of 400 m at the rate of $0.675\ m^3$/sec. The jet of water is deflected through 165° in the bucket with 15% reduction. If the coefficient of velocity for the nozzle is 0.97. Find the power developed by the turbine wheel. **(10 Marks)**

OR

8 a. With a neat sketch, explain the working of a Kaplan turbine. Draw the velocity triangles at inlet and outlet of a turbine. Also explain the function of draft tube. **(10 Marks)**

b. A Kaplan turbine develops 9000 KW under a head of 10 m, overall efficiency of the turbine is 85%. The speed ratio based on the outer diameter is 2.2 and flow ratio is 0.66. The diameter of the boss is 0.4 times the outer diameter of the runner. Determine the diameter of the runner, base diameter and specific speed of the wheel. **(10 Marks)**

Module-5

9 a. Derive an expression for the static pressure rise in the impeller of a centrifugal pump with velocity triangles. **(10 Marks)**

b. A single stage centrifugal pump delivers 1800 litres of water per minute against a total head of 20 m. Its speed is 1450 rpm, inner and outer diameter of the impeller are 120 mm and 240 mm respectively and diameter of suction end and delivery pipes are both 100 mm. Determine the blade angles β1 and β2 if the water enters radially. Also find the power required to drive the pump if the manometric efficiency of the pump is 85% and mechanical efficiency is equal to 88%. **(10 Marks)**

OR

10 a. What do you mean by slip coefficient and power input factor? Obtain an expression for the overall pressure ratio across a centrifugal compressor stage considering ship coefficient and power input factor. **(12 Marks)**

b. An axial flow compressor of 50% reaction design has blades with inlet and outlet angles with respect to axial direction as 45° and 10° respectively. The compressor is to produce a pressure ratio of 6:1 with an overall isentropic efficiency of 0.85 when inlet static temperature is 37°C. The blade speed and axial velocity are constant throughout the compressor. Assuming a value of 200 m/sec for blade speed, find the number of stages required if the work done factor is 0.87 for all the stages. **(08 Marks)**

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17ME54

Fifth Semester B.E. Degree Examination, June/July 2023
Design of Machine Elements – I

Time: 3 hrs. Max. Marks: 100

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 any missing data suitably.

Module-1

1 a. Explain the phases of mechanical engineering design process. **(06 Marks)**

b. A point in a plate grider is subjected horizontal tensile stress of 100 MPa and vertical shear stress of 60 MPa. Find the magnitude of principal stress and its location. **(06 Marks)**

c. Determine maximum normal stress and maximum shear stress at section A – A for crack pin as shown in Fig.Q1(c) when a load of 10 kN is assumed to be concentrated at centre of crank pin.

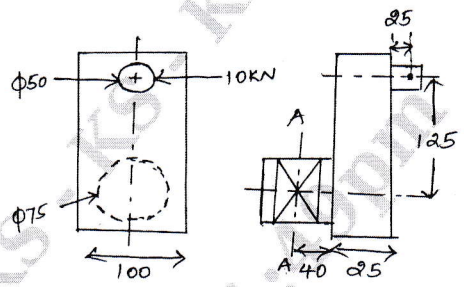


Fig.Q1(c) **(08 Marks)**

OR

2 a. Explain any five methods to reduce stress concentration in mechanical components. **(05 Marks)**

b. A 50mm diameter steel rod supports 9 kN load and in addition is subjected to a torsional moment of 100 N-m as shown in Fig.Q2(b). Determine maximum tensile and maximum shear stress.

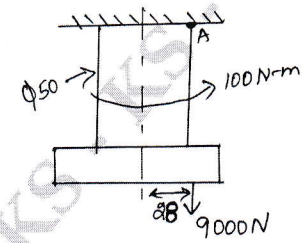


Fig.Q2(b) **(07 Marks)**

c. A stepped shaft as shown in Fig.Q2(c) is subjected to transverse load. Shaft is made of steel with ultimate strength 400 MPa. Determine diameter 'd' taking FOS = 2.

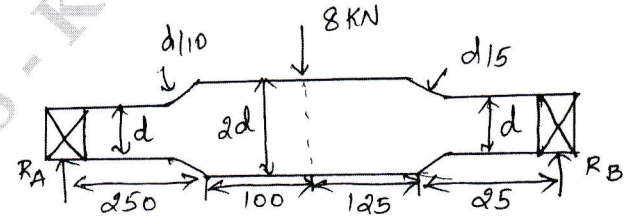


Fig.Q2(c) **(08 Marks)**

Module-2

3 a. A unknown weight falls from a height of 20mm on to a collar rigidly attached to lower end of vertical bar 2m long and 500 sq-mm section. If maximum instantaneous extension is known to be 2mm, what is corresponding stress and value of unknown weight. Take E = 200 GPa. [Refer Fig.Q3(a)]

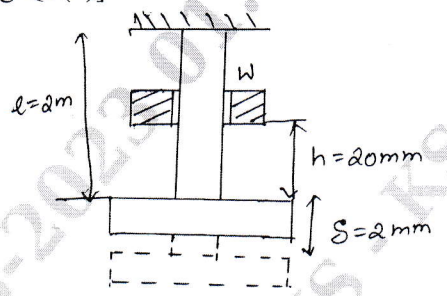


Fig.Q3(a) **(10 Marks)**

b. A elevator car carrying a load of 10 kN is descending by means of steel rope at speed of 1 m/sec. The C/S area of rope is 400 mm^2. Rope is suddenly brought to rest by braking after 30 secs of descent. Calculate stress induced in rope due to sudden stoppage, if $E_{rope} = 80 \times 10^3$ N/mm^2. **(10 Marks)**

OR

4 a. Explain the factors affecting Endurance limit. **(06 Marks)**

b. A steel shaft is subjected to a bending moment that varies from 100 Nm to 200 Nm and transmits 10 kW at 150 rpm. Torque varies over a range of ±40%. Shaft is made of steel with yield strength of 400 MPa and endurance stress 300 N/mm^2. Consider size factor as 1.2, Surface factor 0.9 , FOS = 5, K_{ft} = 1.94. Determine diameter of shaft for infinite life. **(14 Marks)**

Module-3

5 A shaft is supported by bearings placed 1100 mm apart. A pulley of diameter 620mm is keyed at 400mm to the right from left hand bearing and this drives a pulley directly below it with maximum tension of 2.75 kN. Another pulley of diameter 400mm is placed 200mm to left of right hand bearing and is driven with motor placed horizontally to the right. Angle of contact of pulleys is 180° and $\mu = 0.3$. Find diameter of shaft. Assume $C_m = 3.0$, $C_t = 2.5$, $\sigma_y = 190$ MPa , $\sigma_u = 300$ MPa. **(20 Marks)**

OR

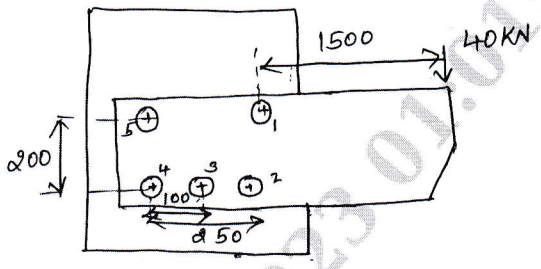
6 a. Design a socket and spigot type cotter joint to sustain axial load of 100 kN. Material selected for joint has following design stresses $\sigma_t = 100$ N/mm^2 ; $\sigma_c = 150$ N/mm^2 ; $\tau = 60$ N/mm^2. **(10 Marks)**

b. In a flange coupling used to connect two co-axial shafts of diameter 80mm to transmit 60 kW at 200 rpm, 6bolts of M14 × 1.5 are used on a bolt circle diameter of 240mm. Hub diameter is 150mm and flange thickness is 20mm. Find (i) Shear stress induced in shaft (ii) Shear stress induced in bolt (iii) Shear stress induced in key if allowable bearing stress on key is 80 MPa. (iv) Shear stress induced in flange. **(10 Marks)**

Module-4

7 a. A double riveted rap joint is to be made between 9mm plates. If safe working stress in tension, shear and crushing are 80 N/mm^2, 60 N/mm^2 and 120 N/mm^2 respectively. Design riveted joint considering it to be chain riveted. **(10 Marks)**

b. Determine the diameter of rivet for a joint loaded as shown in Fig.Q7(b). Allowable stress in rivets is 100 N/mm^2.



Distance between 3rd and 4th rivet is 100mm
Distance between 2nd and 4th rivet is 250mm

Fig.Q7(b) **(10 Marks)**

OR

8 a. A plate of 80mm wide and 10mm thick is to be welded to another plate by means of parallel fillet welds. Plates are subjected to a load of 50 kN. Find the length of weld so that maximum stress does not exceed 50 MPa. Consider joint under static and dynamic loading. [Refer Fig.Q8(a)]

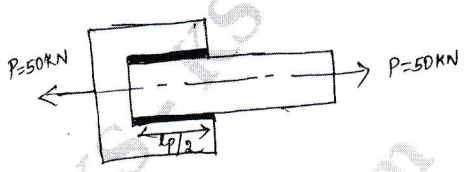


Fig.Q8(a) **(10 Marks)**

b. Determine size of weld required for joint as shown in Fig.Q8(b). If allowable shear stress in weld is 80 N/mm^2.

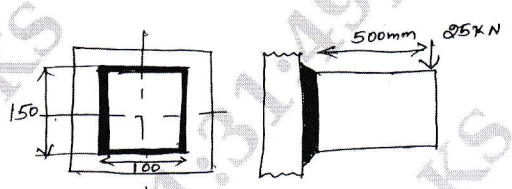


Fig.Q8(b) **(10 Marks)**

Module-5

9 a. A M/O steel bolt of 125mm long is subjected to impact load. Kinetic energy absorbed by bolt is 2.5J. Determine
i) Stress in shank of bolt if there is no threaded portion between nut and bolt head
ii) Stress in shank if area of shank is reduced to that of the root area of thread or entire length of bolt is threaded. **(10 Marks)**

b. The structural connection as shown in Fig.Q9(b) is subjected to eccentricity head P of 10 kN with eccentricity of 500 mm. Centre distance between bolts 1 and 3 is 150mm and between bolts 1 and 2 is 200mm. All bolts are identical. Yield strength of given material is 400 MPa and FOS = 2.5. Find size of bolts.

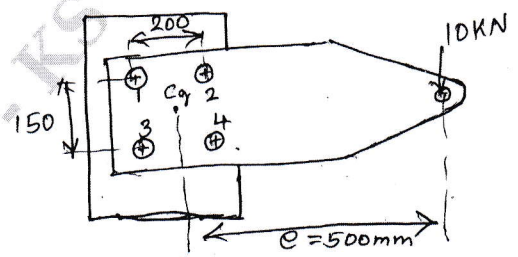


Fig.Q9(b) **(10 Marks)**

OR

10 a. Derive the relation for torque required to lift the load on square threaded screw. **(08 Marks)**

b. A weight of 500 kN is raised at a speed of 6m/min by two screw rods with square threads of 50×8 cut on them. Two screw rods are driven through bevel gear drives by a motor. Determine

i) Torque required to raise the load
ii) Speed of rotation of screw rod assuming threads are double start.
iii) Maximum stress induced on C/S of rod
iv) Efficiency of screw drive
v) Length of nuts for purpose of supporting load
vi) Check overhaul. **(12 Marks)**

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17ME554

Fifth Semester B.E. Degree Examination, June/July 2023
Non-Traditional Machining

Time: 3 hrs. Max. Marks: 100

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

Module-1

1	a.	Explain the classification of modern machining process.	(10 Marks)
	b.	Explain in detail the process selection in NTM process.	(10 Marks)
		OR	
2	a.	Explain the need of development of NTM process.	(10 Marks)
	b.	Differentiate between traditional and Non-traditional machining process.	(10 Marks)

Module-2

3	a.	With a neat sketch explain the WJM process.	(10 Marks)
	b.	Explain the elements of USM process.	(10 Marks)
		OR	
4	a.	With neat sketch, explain the principle and process details of AJM process.	(12 Marks)
	b.	List the advantages and applications of WJM process.	(08 Marks)

Module-3

5	a.	Explain with a neat sketch ECM process.	(12 Marks)
	b.	Discuss the electrolyte flow arrangement in ECM process.	(08 Marks)
		OR	
6	a.	Briefly explain the applications of ECM process.	(10 Marks)
	b.	Explain the principle and working details of CM process.	(10 Marks)

Module-4

7	a.	With neat sketch, explain working principle of EDM process.	(10 Marks)
	b.	Briefly explain the essential requirement of dielectric fluid.	(10 Marks)
		OR	
8	a.	With neat sketch, explain electrode feed control in EDM process.	(10 Marks)
	b.	With a neat sketch, explain plasma arc machining.	(10 Marks)

Module-5

9	a.	Explain with neat sketch the working principle of LBM process.	(12 Marks)
	b.	List out the advantages, disadvantages and application of LBM.	(08 Marks)
		OR	
10	a.	With a neat sketch the generation and control of electron beam.	(12 Marks)
	b.	List out the advantages, disadvantages and applications of EBM.	(08 Marks)

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