

CBCS SCHEME

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15ME51

Fifth Semester B.E. Degree Examination, Dec.2018/Jan.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 chart is permitted.**

Module-1

- 1 a. Define management and explain the functions of management. (08 Marks)
b. Explain briefly the contributions of F.W. Taylor for the scientific management. (08 Marks)

OR

- 2 a. Briefly explain the importance of planning. (08 Marks)
b. Briefly explain the important steps in planning. (08 Marks)

Module-2

- 3 a. Briefly explain the principles of organization. (08 Marks)
b. Briefly explain M.B.O and M.B.E with advantages and disadvantages. (08 Marks)

OR

- 4 a. Explain briefly Maslow's theory of motivation. (08 Marks)
b. What is coordination? Explain the importance of coordination. (08 Marks)

Module-3

- 5 a. With a neat sketch, explain problem solving and decision making. (08 Marks)
b. A 45 years old person is planning for his retired life. He plans to invest Rs.30000 every year for the next 15 years. The bank gives 12% interest rate compounded annually. Find the maturity value when he is 60 years old. (08 Marks)

OR

- 6 a. Explain the law of demand and supply with price versus demand/supply graph. (08 Marks)
b. A person takes a loan of Rs.30,00,000 from a nationalized bank to build a new house at an interest rate of 7.5% compounded annually. This amount has to be repaid in 15 years at equal installments. Find the annual installment that the person has to pay to the bank. (08 Marks)

Module-4

- 7 a. Briefly explain the conditions for present worth comparison. (08 Marks)
b. A granite company is planning to buy a fully automated granite cutting machine. If it is purchased under down payment, the cost of the machine is Rs.16,00,000. If it is purchased under installment basis the company has to pay 25% of the cost at the time of purchase and the remaining amount in 10 annual equal installments of Rs.2,00,000 each. Suggest the best alternative for the company using the present worth basis at $i = 18\%$ compounded annually. (08 Marks)

OR

- 8 a. Explain briefly rate of return, MARR, IRR and ERR. (08 Marks)
- b. A company is trying to diversify its business in a new product line. The life of the product is 10 years with no salvage value at the end of its life. The initial outlay of the project is Rs.20,00,000. The annual net profit is Rs.3,50,000. Find the rate of return for the new business. (08 Marks)

Module-5

- 9 a. Briefly explain the various elements of cost. (08 Marks)
- b. BOSH company produces 500 spark plugs/day, involving direct material cost of Rs.40,000. Direct labour cost of Rs.35,000 and factory overheads of Rs.10,000. Assuming a profit of 15% of the selling price and selling overheads to be 30% of the factory cost. Find the selling price of one spark plug. (08 Marks)

OR

- 10 a. What is depreciation? Explain the causes of depreciation. (08 Marks)
- b. A company has purchased an equipment whose first cost is Rs.1,00,000 with an estimated life of 8 years. The estimated salvage value of the equipment at the end of its life time is Rs.20,000. Find the depreciation and book value for the 5th year using the sum of the years-digits method of depreciation. (08 Marks)

CBCS SCHEME

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15ME52

Fifth Semester B.E. Degree Examination, Dec.2018/Jan.2019 Dynamics of Machinery

Time: 3 hrs.

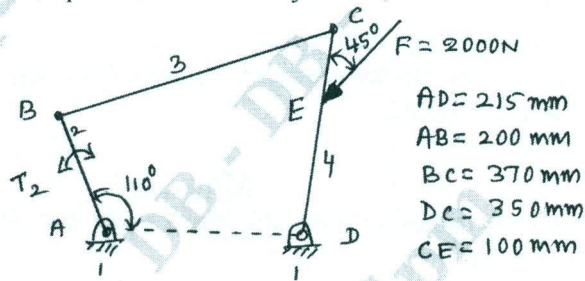
Max. Marks: 80

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

Module-1

- 1 a. State the condition for static equilibrium of a body subjected to a system of
i) two forces ii) three forces iii) member with two forces and a torque. (06 Marks)
- b. For the 4 bar mechanism shown in Fig.Q.1(b), find the required torque T_2 and various P in forces on the links for the equilibrium of the system. (10 Marks)

Fig.Q.1(b)



OR

- 2 a. Explain D'Almerts principle and state its significance. (04 Marks)
- b. In a vertical double acting steam engine, the connecting rod is 4.5 times the crank. The weight of the reciprocating parts is 120kg and the stroke of the Piston is 440mm. The engine runs at 250rpm. If the net load on the Piston due to steam pressure is 25kN when the crank has turned through an angle of 120° from the top dead centre, determine:
i) Thrust in the connecting rod
ii) Pressure on slide bars
iii) Tangential force on the crank pin
iv) Thrust on the bearings
v) Turning moment on the crank shaft. (12 Marks)

Module-2

- 3 a. What do you mean by static and dynamic balancing? (04 Marks)
- b. A, B, C and D are 4 masses carried by a rotating shaft at radii 100, 125, 200 and 150mm respectively. The planes in which the masses revolve are spaced 600mm apart and the mass of B, C and D are 10kg, 5kg and 4kg respectively. Find the required mass A and the relative angular settings of the 4 masses so that the shaft shall be in complete balance. (12 Marks)

OR

- 4 A four crank engine has the two outer cranks set at 120° to each other, and their reciprocating masses are each 400kg. The distance between the planes of rotation of adjacent cranks are 450mm, 750mm and 600mm. If the engine is to be in complete primary balance, find the reciprocating mass and the relative angular position for each of the inner cranks. If the length of each crank is 300mm, the length of each connecting rod is 1.2m and the speed of rotation is 240rpm. What is the maximum secondary unbalanced force? (16 Marks)

Module-3

- 5 a. Explain the following terms relative to governors: i) Stability ii) Sensitiveness
iii) Isochronism iv) Hunting. (08 Marks)
- b. A porter governor has equal arms each 250mm long and pivoted on the axis of rotation. Each ball has a mass of 5kg and the mass of the central load on the sleeve is 15kg. The radius of rotation of the ball is 150mm when the governor begins to lift and 200mm when the governor is at maximum speed. Find the minimum and maximum speeds and the range of speed of the governor. (08 Marks)

OR

- 6 a. With neat sketches, explain the effect of gyroscopic couple on steering, pitching and rolling of a ship. (06 Marks)
- b. An aeroplane flying at 240km/h turns towards the left and completes a quarter circle of 60m radius. The mass of the rotor engine and the propeller of the plane is 450kg with a radius of gyration of 320mm. The engine speed is 2000 rpm clockwise when viewed from the rear. Determine the gyroscopic couple on the aircraft and its effect. In what way is the effect changed when the
i) Aeroplane turns towards right
ii) Engine rotates clockwise when viewed from the front (nose end) and the aeroplane turns left and right. (10 Marks)

Module-4

- 7 a. Add the following harmonic motions analytically and check the solutions graphically:
 $x_1 = 4 \cos (wt + 10^\circ)$
 $x_2 = 6 \sin (wt + 60^\circ)$ (08 Marks)
- b. Find the natural frequency of the system shown in the Fig.Q.7(b) using energy method. (08 Marks)



Fig.Q.7(b)

OR

- 8 a. Find the natural frequency of the system shown in Fig.Q.8(a) using Newton's method. (08 Marks)

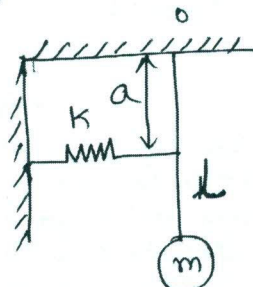


Fig.Q.8(a)

- b. Find the natural frequency of the system shown in Fig.Q.8(b), $K = 2 \times 10^5$ N/m, $m = 20$ kg. (08 Marks)

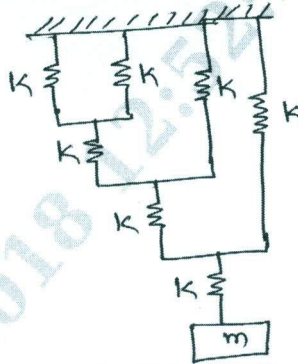


Fig.Q.8(b)

Module-5

- 9 a. Set up the differential equation for a spring mass damper system and obtain complete solution for the critically damped condition. (08 Marks)
- b. Determine:
- Critical damping coefficient
 - Damping factor
 - Natural frequency of damped vibrations
 - Logarithmic decrement
 - Ratio of two consecutive amplitude of vibrating system which consists of mass of 25kg, a spring of stiffness 15 kN/m and a damper. The damping provided is only 15% of the critical value. (08 Marks)

OR

- 10 a. Define transmissibility and derive an expression for the transmissibility ratio and the phase angle for transmitted force. (08 Marks)
- b. A machine of mass one ton is acted upon by an external force 2450N at a frequency of 1500rpm. To reduce the effects of vibration, isolator and rubber having a static deflection of 2mm under the machine load and an estimated damping factor of 0.2 are used. Determine :
- Force transmitted to the foundation
 - Amplitude of vibration of the machine
 - Phase lag of the transmitted force with respect to the external force. (08 Marks)

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Fifth Semester B.E. Degree Examination, Dec.2018/Jan.2019 Turbomachines

Time: 3 hrs.

Max. Marks: 80

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

Module-1

- 1 a. Differentiate between turbo machines and positive displacement machines. (08 Marks)
- b. Test on a turbomachine runner 1.25 m in diameter at 30 m head gave the following results. Power developed = 736 KW. Speed is 180 rpm and discharge 2.7 m³/s. Find the diameter, speed and discharge of a runner to operate at 45 m head and give 1472 KW at the same efficiency. What is specific speed of both the turbines? (08 Marks)

OR

- 2 a. Show that the polytropic efficiency during the expansion process is given by
- $$\eta_p = \frac{\ln \left[\frac{T_2}{T_1} \right]}{\frac{\gamma - 1}{\gamma} \ln \left[\frac{P_2}{P_1} \right]}. \quad (08 \text{ Marks})$$
- b. A stream of combustion gases at the point of entry to a turbine has a static temperature of 1050 K, static pressure of 600 kPa, and a velocity of 150 m/s. For the gases, $C_p = 1.004 \text{ kJ/kgK}$ and $\gamma = 1.41$. Find the total temperature and total pressure of the gases. Also find the difference between their static and total enthalpies. (08 Marks)

Module-2

- 3 a. Derive alternate form of Euler equation and explain each component in that. (08 Marks)
- b. In an inward radial flow hydraulic turbine water enters with an absolute velocity of 15 m/s with a nozzle angle of 15°. The speed of the rotor is 400 rpm. Diameter of the rotor at inlet and outlet are 75 cm and 50 cm respectively. The fluid leaves the rotor radially with an absolute velocity of 5 m/s. Determine: (i) The blade angles (ii) work done (iii) utilization factor. (08 Marks)

OR

- 4 a. Derive theoretical head capacity relation in case of radial flow pump [centrifugal]

$$H = u_2^2 - \frac{u_2^2 Q \cot \beta_2}{A_2}$$

β_2 = discharge blade angle with respect to tangential direction. Explain the effect of discharge angle on it. (08 Marks)

- b. An axial flow compressor has the following data. Entry conditions: 1 bar and 20°C, degree of reaction = 50%, mean blade ring dia = 60 cm, rotational speed = 18000 rpm, blade angle at rotor and stator exit = 65°. Axial velocity = 180 m/s, mechanical efficiency = 96.7%. Find:
- Blade angle at rotor and stator inlet.
 - Power required to drive the compressor. (08 Marks)

Module-3

- 5 a. What is compounding? Explain any two methods of compounding. (08 Marks)
- b. The following particulars refer to a single impulse turbine. Mean diameter of blade ring = 2.5 m, speed = 3000 rpm, nozzle angle = 20° , ratio of blade velocity to steam = 0.4, blade friction factor = 0.8, blade angle at exit is 3° less than that at inlet. Steam flow rate 36000 kg/hr. Draw the velocity diagram and calculate (i) power developed (ii) blade efficiency. (08 Marks)

OR

- 6 a. Derive the condition for maximum efficiency of reaction steam turbine and hence prove that

$$\eta_{b\max} = \frac{2 \cos^2 \alpha_1}{1 + \cos^2 \alpha_1}$$
 (08 Marks)
- b. A Parson's turbine is running at 1200 rpm. The mean rotor diameter is 1m. Blade outlet angle is 23° , speed ratio is 0.75. Stage efficiency is 0.8. Find enthalpy drop in this stage. (08 Marks)

Module-4

- 7 a. Show that for maximum efficiency of pelton wheel the bucket velocity is equal to half of the jet velocity $U = \frac{V_1}{2}$. (08 Marks)
- b. In a power station, a pelton wheel producer 15000 KW under a head of 350 m, while running at 500 rpm. Assume a turbine efficiency of 0.84, coefficient of velocity for nozzle as 0.98, speed ratio 0.46 and bucket velocity coefficient 0.86. Calculate: (i) Number of jet (ii) Diameter of each jet (iii) Tangential force on the buckets if the bucket deflect the jet through 165° . (08 Marks)

OR

- 8 a. With a mathematical expression, define the following:
 i) Hydraulic efficiency ii) Mechanical efficiency
 iii) Overall efficiency iv) Volumetric efficiency (08 Marks)
- b. A Kaplan turbine working under a head of 20 m develops 11772 KW shaft power. The outer diameter of the runner is 3.5 m and hub diameter is 1.75 m. The guide blade angle at the extreme edge of the runner is 35° . The hydraulic and overall efficiency of the turbine are 88% and 84% respectively. If the velocity of whirl is zero at outlet, determine:
 i) Runner vane angles at inlet and outlet at the extreme edge of the runner
 ii) Speed of the turbine. (08 Marks)

Module-5

- 9 a. Define the following:
 i) Suction head ii) Delivery head
 iii) Manometric head iv) Net positive suction head (08 Marks)
- b. A centrifugal pump working in a dock, pumps 1565 ℓ/s , against head (mean lift) of 6.1 m when the impeller rotates at 200 rpm. The impeller diameter is 122 cm and the area at outlet periphery is 6450 cm^2 . If the vanes are set back at an angle of 26° at the outlet, find (i) hydraulic efficiency (ii) power required to drive the pump. If the ratio of external to internal diameter is 2, find the minimum speed to start pumping. (08 Marks)

OR

- 10 a. For axial flow compressor show that $E = v_f u \left[\frac{\tan \beta_2 - \tan \beta_1}{\tan \beta_1 \tan \beta_2} \right]$. (08 Marks)
- b. What are the types of diffusers used in centrifugal compressor? Explain any two. (08 Marks)

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Fifth Semester B.E. Degree Examination, Dec.2018/Jan.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. Any missing data may be suitably assumed.
3. Use of design data hand book is permitted.*

Module-1

- 1 a. List the factors which govern the selection of appropriate material for a machine component. (05 Marks)
b. A stepped shaft with its diameter reduced for '2d' to 'd' has a fillet radius of 0.1d. Determine the diameters of the shaft and the radius of the fillet to transmit a power of 65 KW at a rated speed of 1440 rpm limiting the shear stress induced to 60 MPa. (11 Marks)

OR

- 2 a. Define stress concentration and show how stress concentration can be reduced for two examples with neat sketches. (06 Marks)
b. A cantilever beam of rectangular cross section with a depth of 150 mm is subjected to an axial tensile load of 40 kN and a transverse load of 50 kN acting downwards at the free end of 600 mm length beam. The material of the beam has allowable tensile stress of 100 MPa. Determine the width of rectangular section of the beam. (10 Marks)

Module-2

- 3 a. Derive an expression for impact stress induced in a member subjected to axial load. (06 Marks)
b. A piston rod of steam engine is subjected to a completely reversed axial load of 50 kN. The material of rod has an yield normal stress of 310 N/mm² and endurance stress of 289 N/mm². Assuming load factor of 0.7, size factor as 1 and surface finish factor as 1. Determine the diameter of rod. Choose factor of safety as 2. (10 Marks)

OR

- 4 a. Derive Soderberg's relation for a member subjected to fatigue loading. (06 Marks)
b. A beam of 400 mm depth I-section is resting on two supports 5m apart. It is loaded by a weight of 8 kN falling through a height of 20 mm and striking the beam at mid point. Moment of inertial of the section is $12 \times 10^7 \text{ mm}^4$. Take $E = 2 \times 10^5 \text{ N/mm}^2$. Determine:
i) Impact factor
ii) Instantaneous maximum stress
iii) Instantaneous maximum deflection
iv) Instantaneous maximum load. (10 Marks)

Module-3

- 5 A shaft mounted between bearings 1.2 m apart receives a power of 20 KW at 1000 rpm through a pulley 600 mm diameter located 400 mm from the left bearing from another pulley directly below it. The power is delivered through a pinion of 200 mm diameter located 700 mm from the left bearing to another gear in front of it. The shaft rotates clockwise when viewed through the left bearing. The belt has a ratio of tensions of 2.5 and the gears are of 20° pressure angle. The weight of the pulley is 500 N and that of the gear is 200 N. Determine the diameter of shaft. The material of the shaft has design shear stress of 60 MPa. Choose $K_b = 1.5$, $K_t = 1.0$. (16 Marks)

OR

- 6 a. Design a cotter joint to join two round rods capable of sustaining an axial load of 100 kN. The material of the joint has design tensile stress = 100 N/mm^2 , crushing stress = 150 N/mm^2 and shear stress = 60 N/mm^2 . (08 Marks)
- b. A cast iron flange coupling is used to connect two shafts of 80 mm diameter. The shaft runs at 250 rpm and transmits a torque of 2500 N-m. The permissible shear stress for shaft material and bolt materials is 50 MPa and permissible shear stress for flange is 20 MPa. Design the bolts and the flange. Also select suitable key for the coupling. Take allowable normal stress for bolt as 100 MPa. (08 Marks)

Module-4

- 7 a. Design a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5 m in diameter subjected to a steam pressure of 0.95 N/mm^2 . Assume an efficiency of 72%, allowable tensile stress in the plate of 90 N/mm^2 , crushing stress of 140 N/mm^2 and an allowable shear stress in the rivet of 50 N/mm^2 . (08 Marks)
- b. Determine the size of weld required for an eccentrically loaded weld as shown in Fig.Q7(b). The allowable stress in the weld is 75 MPa.

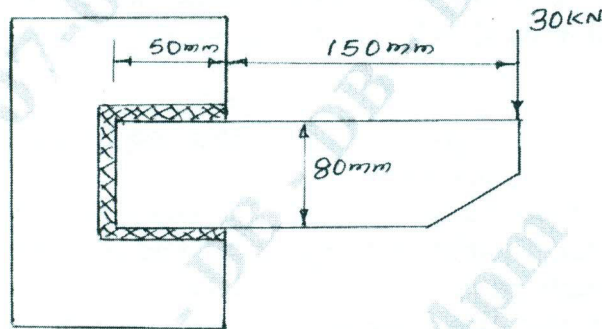


Fig.Q7(b)

(08 Marks)

OR

- 8 a. Two lengths of a flat tie bar for a bridge structure of 250 mm wide and 18 mm thick are connected by a diamond joint with equal cover plates on either side. Design the joint completely working stresses for the material of the bar are 100 MPa in tension, 70 MPa in shear and 160 MPa in crushing. (08 Marks)
- b. One end of a rectangular bar of cross section $120 \text{ mm} \times 70 \text{ mm}$ is welded to a vertical support by four fillet welds along its circumference. A steady transverse load of 10 kN is applied at the free end of the bar of length 160 mm and is parallel to 120 mm side. Determine the size of weld, if the allowable stress in the material is limited to 115 MPa. (08 Marks)

Module-5

- 9 a. A bracket is fixed to the wall by means of four bolts and loaded as shown in Fig.Q9(a). Calculate the size of bolts if the load is 10 kN and allowable shear stress in the bolt material is 40 MPa.

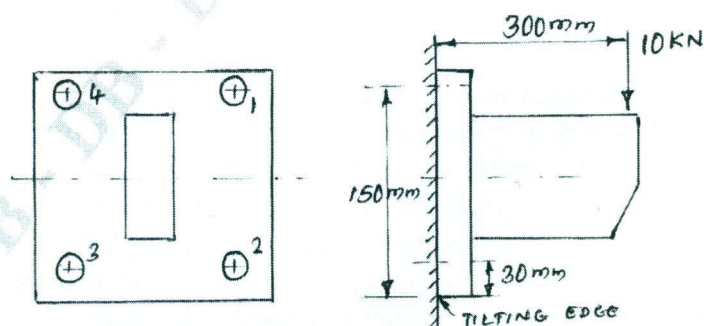


Fig.Q9(a)

(08 Marks)

- b. A square threaded power screw has a nominal diameter of 30 mm and a pitch of 6 mm with double threads. The load on the screw is 6 kN and the mean diameter of the thrust collar is 40 mm. the coefficient of friction for the screw is 0.1 and the collar is 0.09. Determine:
- Torque required to raise and lower the screw with load
 - Overall efficiency

(08 Marks)

OR

- 10 A screw jack is to lift a load of 80 kN through a height of 400 mm ultimate strength of screw material in tension and compression is 200 N/mm^2 and in shear 120 N/mm^2 . The material for the nut is phosphor bronze for which the ultimate strength is 100 N/mm^2 in tension and 90 N/mm^2 in compression and 80 N/mm^2 in shear. The bearing pressure between the nut and the screw is not to exceed 18 N/mm^2 . Design the screw and nut and check for stresses. Take $\text{FOS} = 2$, $\mu = 0.14$. Design jack for 25% overload.

(16 Marks)

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15ME554

Fifth Semester B.E. Degree Examination, Dec.2018/Jan.2019 Non Traditional Machining

Time: 3 hrs.

Max. Marks: 80

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

Module-1

- 1 a. How do you classify Non-traditional machining processes? Discuss briefly. (08 Marks)
b. Compare the traditional and non-traditional machining processes. (08 Marks)

OR

- 2 a. Explain the need for non-traditional machining processes. (08 Marks)
b. Write in brief note on the selection of non traditional machining processes. (08 Marks)

Module-2

- 3 a. With a neat sketch, explain the working principle and operation of USM process. (08 Marks)
b. Discuss the influence of the following parameters on USM process: (08 Marks)
(i) Amplitude and frequency of vibration.
(ii) Abrasive grain size.
(iii) Effect of slurry.
(iv) Applied static load. (08 Marks)

OR

- 4 a. Explain the process variables that influence the metal removal rate in abrasive jet machining. (08 Marks)
b. Mention any two advantages, disadvantages and applications of water jet machining process. (08 Marks)

Module-3

- 5 a. Briefly explain the electrolytes used in ECM process. (08 Marks)
b. With a schematic diagram, explain the Electro Chemical Honing process. (08 Marks)

OR

- 6 a. List out the various process parameters and briefly explain their effects on chemical machining process. (08 Marks)
b. Write a short note on chemical blanking. (08 Marks)

Module-4

- 7 a. With a neat sketch, briefly explain the Feed control in EDM process. (08 Marks)
b. What are the requirements of Dielectric fluid? Mention any two dielectric fluids used in EDM process. (08 Marks)

OR

- 8 a. With a neat sketch, briefly explain PAM process. (08 Marks)
b. Discuss some of the important considerations in the design of plasma Torch in PAM. (08 Marks)

Module-5

- 9 a. With a neat sketch, briefly explain the principle and working of laser beam machining. (08 Marks)
b. What are the advantages and limitations of LBM process? (08 Marks)

OR

- 10 a. With a neat sketch, briefly explain working of electron beam machining. (08 Marks)
b. Write the applications and limitations of Electron Beam Machining (EBM). (08 Marks)

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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.

CBCS SCHEME

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15ME562

Fifth Semester B.E. Degree Examination, Dec.2018/Jan.2019 Energy and Environment

Time: 3 hrs.

Max. Marks: 80

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

Module-1

- 1 a. List and explain the different forms of energy. (06 Marks)
b. Explain briefly the key energy trends in India. (10 Marks)

OR

- 2 a. Discuss briefly the demand and consumption of coal in India. (06 Marks)
b. Explain briefly the factors affecting India's energy development. (10 Marks)

Module-2

- 3 a. Explain the following with one example : (08 Marks)
i) Sensible heat thermal storage system ii) Latent heat thermal storage system.
b. Discuss the energy conservation schemes. (08 Marks)

OR

- 4 a. What is Energy audit and its objectives? (08 Marks)
b. Discuss the steps to be followed in undertaking preliminary energy audit in an industrial company. (08 Marks)

Module-3

- 5 a. Explain with a suitable examples, multidisciplinary nature of environmental studies. (10 Marks)
b. Discuss the need for public awareness of environment management. (06 Marks)

OR

- 6 a. Explain the flow of energy through the various components of the eco system. [Producers, Consumers and Decomposers]. (08 Marks)
b. Explain the concept of ecological pyramids and food chains. (08 Marks)

Module-4

- 7 a. Discuss the major sources and effects of air pollution. (08 Marks)
b. Define Noise pollution. List the major sources and effects of noise pollution. (08 Marks)

OR

- 8 a. With a neat diagram, explain Municipal Solid Waste [MSW] Processing unit. (10 Marks)
b. Discuss the role of individual in pollution prevention. (06 Marks)

Module-5

- 9 a. Explain the phenomenon of global warming, factor contributing global warming and its effect. (10 Marks)
b. What is Acid rain? Explain the causes and effects of acid rain. (06 Marks)

OR

- 10 a. Write short notes on : (10 Marks)
i) The water [Prevention and control of pollution] Act ii) Environment Protection Act.
b. Explain how ozone layer depletion occurs. Discuss the impact of ozone depletion on human health. (06 Marks)

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Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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Fifth Semester B.E. Degree Examination, July/August 2021 Management and Engineering Economics

Time: 3 hrs.

Max. Marks: 80

**Note: 1. Answer any FIVE full questions.
2. Use of Interest factors table is permitted.**

- 1** a. What are the various levels of management? Explain in brief. (08 Marks)
b. Explain the three important roles of manager. (08 Marks)
- 2** a. Discuss the importance of planning and briefly explain the hierarchy of plans. (08 Marks)
b. What is Decision making? What are its objectives? (08 Marks)
- 3** a. What is organizing? What are the various types of organization? (08 Marks)
b. Briefly explain the following:
i) Centralization v/s decentralization
ii) MBO and MBE. (08 Marks)
- 4** a. What is Motivation? Explain MC Gregor's theory X and theory Y of motivation? (08 Marks)
b. What is coordination? Briefly explain the importance and techniques of coordination. (08 Marks)
- 5** a. Explain in brief "Problem solving procedure" in engineering economics. (06 Marks)
b. Explain the following:
i) Price elasticity of demand
ii) Income elasticity of demand. (10 Marks)
- 6** a. Define Interest. Explain effective rate of interest and nominal rate of interest. (08 Marks)
b. A person avails a loan of Rs.10,000/- from a bank at an interest rate of 12% per annum. Find the amount to be repaid in 5 years if the interest is compounded.
i) Annually ii) Semiannually iii) Quarterly iv) Monthly. (08 Marks)
- 7** a. What are the conditions for present worth method of comparison of alternatives? Explain. (06 Marks)
b. An investor can make 3 end of year payments of Rs.15000/- which are expected to generate receipts of Rs.10000/- at the end of year 4, that will increase annually by Rs.2500/- for the following 4 years. Find the present worth of this investment at 10% interest. Use CFD for your analysis. (10 Marks)
- 8** a. What is equivalent annual worth method of comparison of alternatives? What is its advantage? (06 Marks)
b. A parcel of land adjacent to a proposed highway exist is deemed likely to increase in value. It can be purchased now for Rs.80000/- and is expected to be worth Rs.150,000/- (1.5 lakhs) in 5 years. During that period it can be rented for pasture at Rs.1500/year. Annual taxes are presently at Rs.850/year and will likely to remain constant. What rate of return will be earned on this investment? (10 Marks)

- 9 a. With the help of a chart/block diagram, explain the various elements of cost. (07 Marks)
- b. A small firm is producing 100 pens per day. The direct material cost is found to be Rs.160/-, direct labour cost is Rs.200/- and factory overheads to it are Rs.250/-. If the selling and distribution expenses are 40% of the factory cost, what must be the selling price of each pen to realize a profit of 14.6% of the selling price? (09 Marks)
- 10 a. Define Depreciation. What are the various causes of depreciation? (07 Marks)
- b. Find the depreciation amount during 5th year and book value at the end of 8th year using
- Straight line method
 - Declining balance method
 - Sum of the years digits method, for a machinery with an initial cost of Rs.1,50,000/- and a salvage value of Rs.10,000/- after a service life of 10 years. (09 Marks)

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Fifth Semester B.E. Degree Examination, July/August 2021 Dynamics of Machinery

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions.

- 1 a. State the conditions for the equilibrium of the following systems :
- i) Two force member
 - ii) Three force member
 - iii) Member with two forces and a torque
- (06 Marks)
- b. Determine the driving torque T_2 on the crank of a slider crank mechanism shown in Fig Q1(b) for static equilibrium.

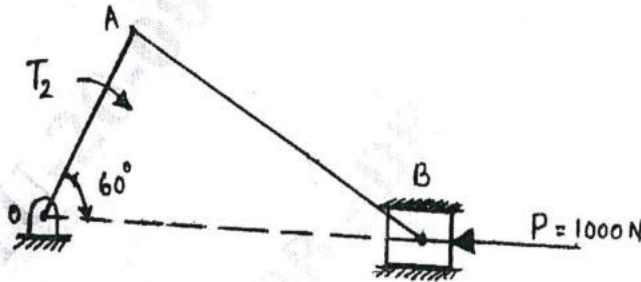


Fig Q1(b)

OA = 100mm
AB = 300mm

(10 Marks)

- 2 a. State and explain D'Alembert's principle. (08 Marks)
- b. 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 bars. The diameter of the cylinder = 0.75m, Stroke of the piston = 0.50m and length of the connecting rod = 1m. Determine the torque on the crank shaft, if the engine runs at 350rpm and the mass of the reciprocating parts is 200kg. (08 Marks)
- 3 a. Explain briefly Static and Dynamic balancing. (04 Marks)
- b. A shaft carries four masses A, B, C and D of magnitude 200kg, 300kg, 400kg and 200kg respectively and revolving at radii 80mm, 70mm, 60mm and 80mm respectively. The distances from the plane A are 300mm, 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 distances between the planes A and X is 100mm, between X and Y is 400mm and between Y and D is 200mm. If the balancing masses revolve at a radius of 100mm, find their magnitudes and angular positions. (12 Marks)
- 4 a. With usual notations, explain the primary and secondary unbalanced forces of reciprocating masses. (04 Marks)
- b. A four crank engine has two outer cranks set at 120° to each other and their reciprocating masses are each 400kg. The distance between planes of rotation of adjacent cranks are 450mm, 750mm and 600mm. If the engine is to be in complete primary balance, find the reciprocating mass and the relative angular position for each of the inner cranks. If the length of each crank is 300mm, the length of each connecting rod is 1.2m and the speed of rotation is 240rpm, find the maximum secondary unbalanced force. (12 Marks)

- 5 a. Derive an expression for the Gyroscopic couple $C = I_p \omega_s \omega_p$. (06 Marks)
- b. In a spring loaded Hartnell governor the extreme radii of rotation of the balls are 80mm and 120mm. The balls arm and sleeve arm of the bell crank lever are equal in length. The mass of each ball is 2kg. If the speeds at the two extreme positions are 400rpm and 420 rpm. Find:
- Spring stiffness
 - Initial compression of the central spring
 - Sleeve lift. (10 Marks)
- 6 a. Define :
- Sensitiveness
 - Stable Governor
 - Governor power (06 Marks)
- b. The rotor of the turbine of a ship has a mass of 5000kg and rotates at a speed of 2100rpm clockwise when viewed from stern. The rotor has a radius of gyration 0.5m. Determine the gyroscopic couple and its effect when,
- The ship steers to the left in a curve of 60m radius at a speed of 16 knots (1 knot = 1860m/hr)
 - The ship pitches 6° above and 6° below the horizontal position and the bow is descending with its maximum velocity. The pitching motion is simple harmonic with a periodic time of 20 seconds
 - The ship rolls and at that instant the angular velocity is 0.03 rad/sec clockwise when viewed from the stern. (10 Marks)
- 7 a. Define the following terms :
- Natural frequency
 - Degrees of freedom
 - Resonance
 - Free and forced vibrations
 - Damped and undamped vibrations (10 Marks)
- b. Add the following motions analytically
 $x_1 = 3 \sin(\omega t + 30^\circ)$, $x_2 = 4 \cos(\omega t + 10^\circ)$ (06 Marks)
- 8 a. Derive the differential equation of a spring mass system using Newton's and Energy method. (08 Marks)
- b. Two masses m_1 and m_2 are connected to the rod as shown in Fig Q8(b). Determine the natural frequency of the system.

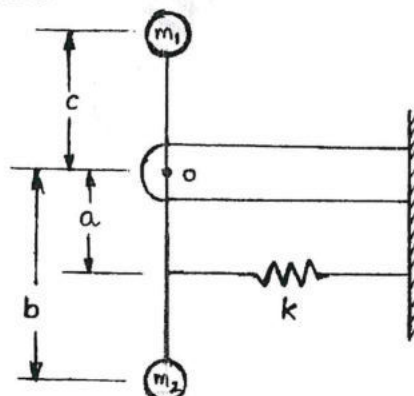


Fig Q8(b)

(08 Marks)

- 9 a. Define logarithmic decrement. Show that logarithmic decrement δ is given by $\frac{2\pi\xi}{\sqrt{1-\xi^2}}$ for underdamped system. (06 Marks)
- b. A spring mass damper system has $m = 3\text{kg}$, $k = 100\text{N/m}$, $c = 3\text{ N-sec/m}$. Determine :
- Damping factor
 - Natural frequency of damped vibration
 - Logarithmic decrement
 - The ratio of two successive amplitudes
 - Number of cycles after which the original amplitude is below 20% (10 Marks)
- 10 a. Show that providing damping in vibration isolation is not useful when the frequency ratio is more than $\sqrt{2}$ or 1.44. (06 Marks)
- b. A machine of total mass 17kg is mounted on springs having stiffness $K = 11 \times 10^5\text{N/m}$. A Piston within the machine has a mass of 2kg has a reciprocating motion with stroke 7.5cm and speed 6,000rpm. Assuming the motion to be S.H.M. Determine :
- Maximum amplitude of vibration
 - Transmissibility
 - Force transmitted to the ground or foundation.
- Take $\xi = 0.2$. (10 Marks)

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Fifth Semester B.E. Degree Examination, July/August 2021

Turbo Machines

Time: 3 hrs.

Max. Marks: 80

Note:1. Answer any FIVE full questions.

2. Use of Thermodynamics Data Hand Book, Steam tables and Mollier chart permitted.

- 1
 - a. Define a turbo machine. Mention any five differences between a turbo machine and a positive displacement machine. (06 Marks)
 - b. Define specific speed of a turbine. Explain its significance. (03 Marks)
 - c. A Francis turbine model is built to a scale of 1 : 5. The data for the model is $P = 6$ kW, $N = 350$ rpm, $H = 3$ m and for prototype $H = 9$ m. Assuming the overall efficiency of the model as 75%, calculate :
 - (i) Speed of the prototype
 - (ii) Power of the prototype.
 Use Moody's equation. (07 Marks)

- 2
 - a. Show that the polytropic efficiency for a compression process is given by $\eta_p = \left(\frac{n}{n-1} \right) \left(\frac{\gamma-1}{\gamma} \right)$ where γ is the ratio of specific heats and n is the index of compression. (08 Marks)
 - b. Air flows through an air turbine where its stagnation pressure is decreased in the ratio 5 : 1. Total-to-Total efficiency is 0.8. The air flow rate is 5 kg/s. If the total power output is 500 kW, find : (i) Inlet total temperature (ii) Actual exit total temperature (iii) Actual exit static temperature if the flow velocity is 100 m/s. (iv) Total-to-static efficiency. (08 Marks)

- 3
 - a. Define degree of reaction. Show that the relationship between the utilization factor ϵ and the degree of Reaction R for an axial flow turbine is given by $\epsilon = \frac{V_1^2 - V_2^2}{V_1^2 - RV_2^2}$ where V_1 and V_2 are the absolute velocity of fluid at inlet and outlet respectively. (08 Marks)
 - b. At a stage in a 50% degree of reaction axial flow turbine running at 3000 rpm, the blade mean diameter is 68.5 cm. If the maximum utilization factor for the stage is 0.915, calculate the inlet and outlet absolute velocities for the rotor assuming the velocity triangles at inlet and outlet to be symmetric. Find also the power output for a flow rate of 15 kg/s. (08 Marks)

- 4
 - a. Draw the velocity triangles for an axial flow compressor and show that for an axial flow compressor with no axial thrust, the degree of reaction is given by $R = \frac{V_a}{2u} \left[\frac{\tan \beta_1 + \tan \beta_2}{\tan \beta_1 \tan \beta_2} \right]$ where $V_a =$ Axial flow velocity, $u =$ Blade speed, β_1 and $\beta_2 =$ Inlet and Outlet blade angles with respect to tangential direction. (10 Marks)
 - b. In a mixed flow compressor handling air at 16000 rpm, the stagnation temperature of air at compressor inlet and outlet are respectively 27°C and 215°C. The absolute velocity of air at the rotor inlet is axial while at the exit, the tangential component of absolute velocity is 0.93 times the tangential impeller speed. If the mass flow rate of air through the impeller is 15 kg/s and specific heat is assumed to be constant, find the impeller diameter and total power input. (06 Marks)

- 5 a. What do you mean by compounding of steam turbine? Explain with the help of a schematic diagram, a two row velocity compounded turbine stage. (06 Marks)
- b. A single stage impulse wheel is supplied with super heated steam at 15 bar and 250°C, expands to 0.5 bar condenser pressure. The rotors are fitted with equi angular blades moving at 450 m/s. If the nozzle angle at the rotor inlet is 16° to the wheel plane, find the specific power output, blade efficiency, grass stage efficiency and direction of exit steam velocity. Assume nozzle efficiency as 94% and assume the relative velocities as equal. (10 Marks)
- 6 a. Show that the maximum blade efficiency of a Parson's reaction turbine is,
- $$(\eta_b)_{\max} = \frac{2 \cos^2 \alpha_1}{1 + \cos^2 \alpha_1}$$
- where α_1 = nozzle angle at inlet. (09 Marks)
- b. The following particulars refer to a Parson's reaction turbine consisting of one ring of fixed blades and one ring of moving blades. The mean diameter of the blade ring is 90 cm and its speed is 3000 rpm. The inlet absolute velocity to the blades is 350 m/s. The blade outlet angle is 20°. The steam flow rate is 7.2 kg/s. Calculate (i) The blade inlet angle (ii) Tangential force (iii) Power developed. (07 Marks)
- 7 a. With suitable velocity triangles, derive an expression for the maximum hydraulic efficiency of a Pelton wheel in terms of blade velocity co-efficient and outlet blade angle. (08 Marks)
- b. A 137 mm diameter jet of water issuing from a nozzle impinges on the buckets of a Pelton wheel and the jet is deflected through an angle of 165° by the buckets. The head available at the nozzle is 400 m. Assuming coefficient of velocity as 0.97, speed ratio as 0.46 and reduction in the relative velocity while passing through the buckets as 15%, find (i) Force exerted by the jet on the buckets in the tangential direction (ii) theoretical power developed. (08 Marks)
- 8 a. List the functions of a draft tube in a reaction hydraulic turbine. Using Bernoulli's equation, show that the pressure head at the inlet of the draft tube is less than the atmospheric pressure head. (06 Marks)
- b. The following data is given for a Francis turbine : Net head = 70 m, Speed = 600 rpm, Shaft power = 368 kW, Overall efficiency = 85%, hydraulic efficiency = 95%, Flow ratio = 0.25, Breadth ratio = 0.1, Outer diameter of the runner = 2 × inner diameter of the runner. Velocity of flow is constant at inlet and outlet. The thickness of the vanes occupies 10% of the circumferential area of the runner and the discharge is radial at outlet. Determine : (i) Guide blade angle (ii) Runner vane angles at inlet and outlet. (iii) Diameter of runner at inlet and outlet (iv) Width of the runner at inlet. (10 Marks)
- 9 a. What is Priming? Why priming is required in centrifugal pumps? (03 Marks)
- b. Derive an expression for minimum starting speed of a centrifugal pump. (06 Marks)
- c. A 4-stage centrifugal pump has impellers each of 38 cm diameter and 1.9 cm wide at outlet. The outlet vane angle is 45° and the vanes occupy 8% of the outlet area. The manometric efficiency is 84% and overall efficiency is 75%. Determine the head generated by the pump when running at 900 rpm discharging 59 litres/s of water. Also determine the power required. (07 Marks)
- 10 a. Explain the following with appropriate sketches :
 (i) Surging (ii) Choking (iii) Pre-rotation. (09 Marks)
- b. A centrifugal compressor runs at a speed of 15000 rpm and delivers 30 kg/s of air. The exit diameter is 70 cm. The relative velocity at exit is 100 m/s at an exit blade angle of 75°. Assume radial inlet. The inlet total temperature and pressure are 300 K and 1 bar respectively. Determine :
 (i) Power required to drive the compressor (ii) Ideal head developed
 (iii) Total exit pressure. (07 Marks)

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Fifth Semester B.E. Degree Examination, July/August 2021 Design of Machine Elements – I

Time: 3 hrs.

Max. Marks: 80

- Note: 1. Answer any FIVE full questions.
2. Use of design data hand book is permitted.
3. Assume missing data, if any, suitably.**

- 1 a. Define Mechanical Engineering design. Explain phases of design with a neat block diagram. (06 Marks)
- b. A hollow shaft of 40 mm outer diameter and 25 mm inner diameter is subjected to a twisting moment of 118 N-m, axial tensile load of 10 kN and a bending moment of 80 N-m. Calculate the maximum tensile and maximum shear stress. (10 Marks)
- 2 a. A grooved shaft shown in Fig.Q2(a) transmits 10 KW at 1000 rpm. Determine the diameter of the shaft at the groove. The permissible stress for the shaft material can be taken as 150 MPa.

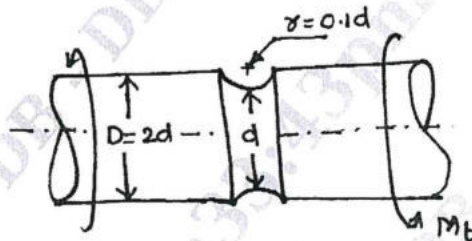


Fig.Q2(a)

(08 Marks)

- b. A link made of grey cast iron having a permissible stress of 100 MPa is subjected to a force of 25 kN as shown in Fig.Q2(b). Determine the dimensions of the cross-section of the link.

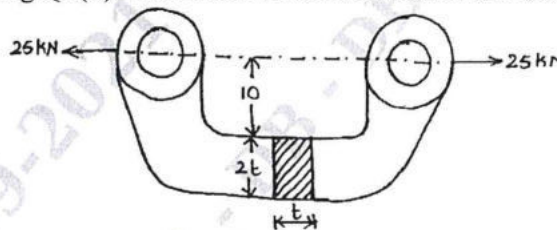


Fig.Q2(b)

(08 Marks)

- 3 a. Derive an expression for impact stress in a axial bar of cross-section 'A' and length 'L' due to impact of a load 'W' falling from a height 'h'. (08 Marks)
- b. A mass of 50 kg drops through 25 mm at the center of a 250 mm long simply supported beam. The beam has square cross-section having an allowable stress of 200 MPa. Determine the dimensions of the cross-section of the beam. Take $E = 207 \text{ GPa}$. (08 Marks)
- 4 A round rod of diameter $1.2 d$ is reduced to a diameter ' d ' with a fillet radius of $0.1d$. The stepped rod is to sustain a twisting moment that fluctuates between $+2.5 \text{ kN-m}$ and $+1.5 \text{ kN-m}$ together with a bending moment that fluctuates between $+1 \text{ kN-m}$ and -1 kN-m . The rod is made of carbon steel C40 ($\sigma_y = 328.6 \text{ MPa}$; $\sigma_u = 620 \text{ MPa}$). Determine a suitable value for ' d '. (16 Marks)

5. A commercial steel shaft transmits 15 kW at 300 rpm. It is supported on two bearings 1.2 m apart. The shaft receives power through a 450 mm diameter pulley mounted at 300 mm to the right of right bearing. The power is given out through a 300 mm diameter gear mounted at 250 mm to the right of left bearing. The belt drive is horizontal and gear drive with a downward tangential force. Design the shaft. Allowable stress for the shaft with keyway is 40 MPa. Take $K_b = K_t = 1.5$ and ratio of belt tension = 3. (16 Marks)
6. Design a cast iron flange coupling to connect two shafts of 45 mm diameter to transmit 20 KW power at 400 rpm. The permissible shear strength for the shaft, bolt and the key is 50 MPa and the permissible compressive stress is 120 MPa. The permissible shear stress for cast iron is 15 MPa. Assume starting torque is 30 percent higher than the normal torque. Take keyway factor as 0.75. (16 Marks)
7. a. Design a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5 m in diameter subjected to a steam pressure of 0.95 N/mm^2 . Assume an efficiency of 75%, allowable tensile stress in the plate is 90 N/mm^2 , allowable crushing stress of 140 N/mm^2 and an allowable shear stress in the rivet as 56 N/mm^2 . (08 Marks)
- b. Determine the load carrying capacity for the riveted joint shown in Fig.Q7(b). The allowable stress in the 20 mm diameter rivet is 100 N/mm^2 .

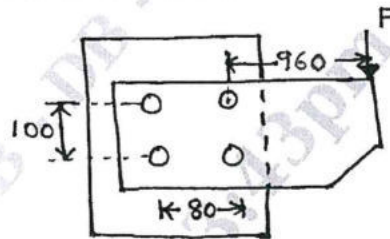


Fig.Q7(b)

(08 Marks)

8. a. A welded joint shown in Fig.Q8(a) is subjected to an eccentric load of 2.5 kN. Find the size of the weld if maximum stress in the weld is 25 MPa.

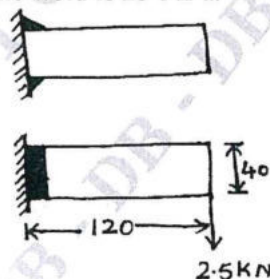


Fig.Q8(a)

(08 Marks)

- b. Find the size of the weld for a bracket loaded as shown in the Fig.Q8(b). The allowable stress for the weld may be taken as 75 MPa.

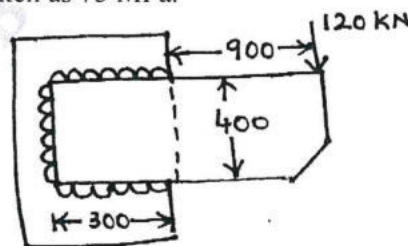


Fig.Q8(b) All dimensions are in mm

(08 Marks)

- 9 a. A M10 steel bolt of 125 mm long is subjected to an impact load. The kinetic energy absorbed by the bolt is 2.5 J. Determine:
- Stress in the shank of the bolt if there is no threaded portion between the nut and the bolt head.
 - Stress in the shank if the area of the shank is reduced to that of the root area of the thread or the entire length of the bolt is threaded.
- Take $E = 206 \text{ GPa}$. (08 Marks)
- b. A steel bracket subjected to a force of 10 kN and fixed to a channel is as shown in Fig.Q9(b). Determine the size of the bolt if the allowable shear stress in the material is 70 N/mm^2 .

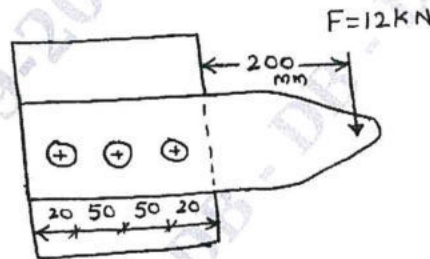


Fig.Q9(b)

(08 Marks)

- 10 a. A split nut used with a lead screw is propelled at a speed of 5 m/min, against a load of 20 kN, along the spindle of a square thread (single start) having nominal diameter of 30 mm and pitch of 6 mm. The axial thrust is absorbed by a collar of 100 mm outside diameter and 70 mm inside diameter. Assuming suitable coefficient of friction, determine:
- Power required to drive
 - Height of bronze nut required if allowable bearing pressure is 17 MPa
 - Efficiency of the drive. (08 Marks)
- b. A Sluice gate weighing 600 kN is raised and lowered by two 75 mm square threaded screw. The screws are operated by a 600 rpm motor. The coefficient of collar friction is 0.03 and coefficient of thread friction is 0.14. The outer diameter of the collar is 100 mm and inner diameter is 50 mm. The gate is to be raised at a rate of 0.6 m/min. Determine the power required to raise the gate. (08 Marks)

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Fifth Semester B.E. Degree Examination, July/August 2021 Non Traditional Machining

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions.

- 1 a. Classify the NTM processes on the basis of type of energy, mechanism of metal removal, transfer media, energy source. (08 Marks)
b. Explain the need for NTM processes. (08 Marks)
- 2 a. Differentiate between traditional and non traditional machining process. (08 Marks)
b. Give the various aspects to be considered before selecting a NTM. (08 Marks)
- 3 a. Sketch and explain the principle, equipment and operation of Abrasive jet machining process. (10 Marks)
b. During AJM process, the mixing ratio is 0.2. Calculate the mass ratio if the density of abrasive and density of carrier gas is 20. (06 Marks)
- 4 a. Explain the principle of water jet machining process. (06 Marks)
b. Discuss the following parameters on USM process
i) Amplitude and vibration frequency
ii) Abrasive grain size
iii) Slurry
iv) Effect of applied static load (feed force)
v) Tool and work material. (10 Marks)
- 5 a. Sketch and explain the principle, equipment and operation of ECM. (08 Marks)
b. Explain the effect of following parameters on ECM:
i) Electrolyte
ii) Tool feed rate
iii) Velocity of electrolytic flow
iv) Gap between work piece and tool. (08 Marks)
- 6 a. Explain with a neat sketch electro chemical honing. State its advantages and disadvantages. (10 Marks)
b. Briefly explain the process characteristics in chemical machining process. (06 Marks)
- 7 a. Explain with a neat sketch the principle, equipment and operation of EDM process. (10 Marks)
b. Sketch and explain any two methods of flushing used in EDM. (06 Marks)
- 8 a. Explain the following process parameters:
i) Torch-work piece distance
ii) Gas flow rate. (04 Marks)
b. What are the advantages of PAM? (04 Marks)
c. With a neat sketch, explain principle of PAM. (08 Marks)

- 9 a. With a neat sketch, explain the basic principle, advantages/disadvantages application of LBM. (10 Marks)
- b. Discuss about i) CO₂ laser ii) Nd-YAG , used in LBM. (06 Marks)
- 10 a. Explain the generation and control of electron beam with schematic diagram. (06 Marks)
- b. Explain with a neat sketch, the working principle of EBM. State the advantages, disadvantages and applications of EBM. (10 Marks)

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Fifth Semester B.E. Degree Examination, July/August 2021

Energy and Environment

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions.

- 1 a. Write a short note on energy and power. Also list out various forms of primary energy sources. (08 Marks)
b. Explain how energy flow from one form to another by illustrating an example of typical energy chain. (08 Marks)
- 2 a. Write a short note on key energy trends in India in terms of, (i) Demand (ii) Electricity (iii) Access to modern energy (iv) Energy production and trade. (08 Marks)
b. What are the key factors affecting India's energy development? (08 Marks)
- 3 a. Write a short note on thermal energy storage methods. Also illustrate an example of thermal energy storage system. (08 Marks)
b. Write a short note on principles of energy management. (08 Marks)
- 4 a. Briefly explain methodology of energy audit with respect to process industries. (08 Marks)
b. Explain characterization of an investment project. (08 Marks)
- 5 a. Define environment. Briefly explain multidisciplinary nature of environment studies. (08 Marks)
b. Explain the importance of environmental education in the present day context. (08 Marks)
- 6 a. Explain the flow of energy through the various components of ecosystem. (08 Marks)
b. Explain the following :
(i) Structure and functioning of grass land ecosystem.
(ii) Structure and functioning of aquatic ecosystem. (08 Marks)
- 7 Write a short note on:
a. Air pollution.
b. Soil pollution.
c. Noise pollution.
d. Thermal pollution. (16 Marks)
- 8 Write a short note on:
a. Solid waste management.
b. Hazardous waste management.
c. Pollution prevention.
d. Disaster management. (16 Marks)
- 9 a. Explain phenomenon of global warming and factors contributing to it. (08 Marks)
b. What are the major causes of nuclear hazards and accidents? (08 Marks)
- 10 Write a short note on:
a. Environment Protection act.
b. Air prevention and control of pollution act.
c. Water prevention and control of pollution act.
d. Forest conservation act. (16 Marks)

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Fifth Semester B.E. Degree Examination, July/August 2021 Management and Engineering Economics

Time: 3 hrs.

Max. Marks: 100

**Note: 1. Answer any FIVE full questions.
2. Use of Interest chart is permitted.**

- 1
 - a. Define Management. List and explain different interpersonal roles played by a Senior Manager. (08 Marks)
 - b. Briefly explain Management and Administration. (04 Marks)
 - c. List and explain important contributions made by F.W. Taylor under Scientific Management. (08 Marks)
- 2
 - a. Compare Strategic planning and Tactical planning. (04 Marks)
 - b. Explain briefly the guidelines for making planning effective. (06 Marks)
 - c. Identify the situations for Individual and Group decisions. Briefly explain the advantages and disadvantages of Group decision. (10 Marks)
- 3
 - a. What is Span of Control? Briefly explain the factors governing the span of control. (06 Marks)
 - b. What do you mean by a Committee? How are they broadly classified? Briefly explain. (04 Marks)
 - c. Briefly explain the Selection Procedure. (10 Marks)
- 4
 - a. Briefly explain the essentials of Effective Control System. (08 Marks)
 - b. Explain the important characteristics of leadership. (04 Marks)
 - c. Define Communication. List some of the important purposes of communication. (08 Marks)
- 5
 - a. With a neat block diagram, explain the process of problem solving and decision making in Engineering Economics. (10 Marks)
 - b. Explain Law of Demand and Supply with suitable example. (06 Marks)
 - c. Define the Law of Return and explain the three phases of Law of return. (04 Marks)
- 6
 - a. Define Compound Interest. Briefly explain the three types of Compound Interest. (06 Marks)
 - b. With a neat diagram, explain Cash Flow diagram. (06 Marks)
 - c. A person wants to give Rs 25,000 as scholarship every year in memory of his late father. He wants to deposit a lump sum in the bank which makes him to receive the required amount every year for the next 20 years. The reserve is assumed to grow annually at the rate of 9%. Find the single payment that must be made now as the reserve amount. (08 Marks)
- 7
 - a. How are assets with unequal lives compared? (05 Marks)
 - b. Explain the "Rule of 72" as applied to Present worth comparisons. (05 Marks)
 - c. Compare the Present worth of the following alternatives using an interest rate of 7% :

	Plan A	Plan B	Plan C
Life Cycle (years)	6	3	4
First cost (Rs)	2,000	8,000	10,000
Annual cost (Rs)	3,200	700	500

(10 Marks)

- 8 a. Explain i) Ownership life ii) Accounting life iii) Economic life. (06 Marks)
b. Explain : i) MARR ii) IRR. (04 Marks)
c. A patch of land adjacent to International Airport is likely to increase in value. The cost of the land now is Rs 8,00,000 and expected worth is Rs 15,00,000 within 5 years. During the period it can be rented for a small Industry at Rs 15,000 per year. Annual taxes are Rs 8,500 and likely to remain constant. What rate of return will be earned on the investment if the estimates are accurate? (10 Marks)
- 9 a. Differentiate between Estimation and Costing. (04 Marks)
b. Explain the following terms :
i) Prime cost ii) Factory cost iii) Cost of Production iv) Total cost. (06 Marks)
c. Two operators are engaged on forging machine for 25 jobs, each weighing 4 kg in a shift of 8 hrs. They are paid at the rate of Rs 100/hr and Rs 80/hr per day. The forged material costs Rs 3.50 per kg. If the factory and administrative on costs put together are twice the labour cost , find the cost of production per unit. (10 Marks)
- 10 a. What is Depreciation? List different methods of determining depreciation. Explain any two of them. (10 Marks)
b. A Company has purchased an equipment whose first cost is Rs 2,00,000 with an estimated life of eight years. The estimated salvage value of the equipment is Rs 40,000 at the end of its lifetime. Determine the depreciation change and book value at the end of various years using sum of years digits method of depreciation. (10 Marks)

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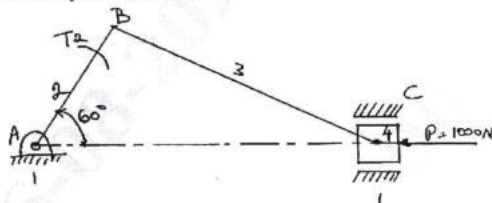
Fifth Semester B.E. Degree Examination, July/August 2021 Dynamics of Machinery

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions.

- 1 a. State the condition for static equilibrium of a body subjected to a system of (i) Two forces, (ii) Three forces (iii) Member with two forces and a torque. (06 Marks)
- b. Determine the required input torque on the crank of a slider crank mechanism shown in Fig. Q1 (b) for static equilibrium. (14 Marks)



AB = 100 mm,
BC = 300 mm

Fig. Q1 (b)

- 2 a. State and explain D'Alembert's principle. (06 Marks)
- b. A horizontal gas engine running at 240 rpm has a bore of 500 mm and a stroke of 600 mm. The length of connecting rod is 1.2 m and the mass of the reciprocating parts is 200 kg. The difference between driving and back pressure is 0.4 N/mm^2 when the crank has turned through an angle of 60° from the inner dead centre. Neglecting the effect of piston rod, Determine
- (i) Net force on the piston or piston effort.
 - (ii) Thrust in the connecting rod.
 - (iii) Pressure in the slide bars.
 - (iv) Tangential force on the crank pin.
 - (v) Thrust on the bearings.
 - (vi) Turning moment on the crank shaft.
 - (vii) Acceleration of the flywheel which has a mass of 100 kg and radius of gyration of 500 mm while the power of the engine is 100 kW. (14 Marks)
- 3 a. Briefly explain the static and dynamic balancing. (06 Marks)
- b. Two masses m_1, m_2, m_3, m_4 and m_5 revolve in the same plane. Magnitudes of m_1, m_2 and m_3 are 5, 2.5 and 4 kg respectively. Angular positions of m_2, m_3, m_4 and m_5 are $60^\circ, 135^\circ, 210^\circ$ and 270° from m_1 . Determine the masses m_4 and m_5 . (14 Marks)
- 4 In a four cylinder engine the two outer cranks are at 120° to each other and their reciprocating masses are each 100 kg. The distance between the planes of rotation of adjacent cranks are 450 mm, 750 mm and 450 mm. Length of each crank is 300 mm and length of each connecting rod is 1200 mm. Speed of engine is 240 rpm. Find
- (i) The reciprocating masses and relative angular positions for each of the inner cranks.
 - (ii) The unbalanced secondary forces and couples if any, measured about the central plane for this arrangement arrived at for primary balancing. (20 Marks)
- 5 a. Define the following with respect to the working of Governors:
- (i) Sensitiveness
 - (ii) Isochronism
 - (iii) Hunting of governor
 - (iv) Effort of a governor
 - (v) Stability of a governor (10 Marks)

- b. Each ball of a Governor has a mass of 1.5 kg attached to one arm of a bell crank lever. The other arms of bell crank lever lift the sleeve against the force exerted by the spring under compression which surrounds the governor spindle. Length of ball and sleeve arms are 125 and 75 mm. Fulcrum is 90 mm from the axis. Maximum and minimum radii are 115 and 75 mm. The sleeve begins to lift at a speed of 300 rpm. Maximum speed is 6% greater. Find the rate of spring or stiffness and equilibrium speed for the radius 90 mm. (10 Marks)
- 6 a. Analyze the stability of a two wheel vehicle taking left turn. Derive the necessary equations. (10 Marks)
- b. An aeroplane makes a complete half circle of 50 m radius towards left when flying at 200 km/hr. The mass of the rotary engine and propeller is 400 kg with radius of gyration 300 mm. The engine runs at 3000 rpm counter clockwise when viewed from the rear. Determine the gyroscopic couple and its effect on the air craft. (10 Marks)
- 7 a. Define the following with respect to vibration:
 (i) Simple Harmonic Motion (SHM).
 (ii) Degrees of freedom.
 (iii) Phase difference.
 (iv) Resonance.
 (v) Damping. (10 Marks)
- b. Add the following harmonic motions and check the solution graphically,
 $x_1 = 2 \cos(\omega t + 0.5)$
 $x_2 = 5 \sin(\omega t + 1.0)$ (10 Marks)
- 8 a. Determine the natural frequency of a spring mass system where the mass of the spring is also to be taken into account. (06 Marks)
- b. An oscillating system with a natural frequency of 3.98 Hz starts with an initial displacement of $x_0 = 10$ mm and an initial velocity of $\dot{x}_0 = 125$ mm/sec. Calculate all the vibratory parameters involved and the time taken to reach the first peak. (14 Marks)
- 9 a. State the types of damping and explain the differential equation of viscous damping. (08 Marks)
- b. Large guns are designed so that on firing the bavel records against a spring. At the end of the record a dash pot is engaged that allows the bavel to return to its initial position in the minimum time without oscillation. Determine the proper spring constant and the dashpot damping co-efficient for a bavel having a mass of 900 kg. Initial recorded velocity at the instant of firing is 25 m/sec and the distance recorded is 1.5 m. Also find the time required for the bavel to return to a position 0.15 m from the initial position if the time for recorded is $\frac{1}{4}$ of time period. (12 Marks)
- 10 a. Show that providing damping in vibration isolation is not useful when the frequency ratio is more than 1.414 or $\sqrt{2}$. (08 Marks)
- b. A machine of total mass 68 kg mounted on springs of stiffness $k = 11,000$ N/cm. With an assumed damping factor $\xi = 0.2$. A piston within the machine has a mass of 2 kg has a reciprocating motion with stroke 7.5 cm and a speed of 3,000 rpm. Assuming the motion of piston to be S.H.M. Determine
 (i) Amplitude of machine
 (ii) Phase angle with respect to exciting force.
 (iii) Transmissibility and force transmitted to foundation.
 (iv) Phase angle of transmitted force with respect to exciting force. (12 Marks)

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Fifth Semester B.E. Degree Examination, July/August 2021 Turbo Machines

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions.

- 1
 - a. Summarize the difference between a positive displacement machines and turbomachines. (08 Marks)
 - b. Test on a turbomachine runner of diameter 1.25m runs at 30m head and gave the following results. Power developed – 736kW, speed of 180rpm with a discharge of 2.7m³/s. Find the diameter, speed and discharge of a runner to operate at 45m head and gives 1472kW at the same efficiency. What is specific speed of both the turbines? (08 Marks)
 - c. Discuss briefly the effect of Reynold's number on a fluid flow in turbomachines. (04 Marks)
- 2
 - a. Show that the polytropic efficiency during the process of expansion is given by

$$\eta_p = \frac{\ell_n \left(\frac{T_2}{T_1} \right)}{\frac{\gamma-1}{\gamma} \ell_n \left(\frac{P_2}{P_1} \right)} \quad (10 \text{ Marks})$$

- b. A stream of combustion gases at the point of entry to a turbine has a static temperature of 1050K, static pressure of 600kPa and a velocity of 150m/s. For the gases, $C_p=1.004\text{kJ/kg K}$ and $\gamma=1.41$. Find the total temperature and total pressure of the gases. Also find the difference between their static and total enthalpies. (10 Marks)
- 3
 - a. Considering the elements of energy transfer. Derive an alternate form of Euler Turbine equation. (10 Marks)
 - b. In an axial flow turbine, the discharge blade angles are 20° each, for both the stator and the rotor. The steam speed at the exit of the fixed blade is 140m/s. The ratio of $\frac{V_a}{u} = 0.7$ at the entry and 0.76 at the exit of the rotor blade. Find: i) The inlet rotor blade angle ii) Power developed by the blade ring for a mass flow rate of 2.6kg/sec iii) Degree of reaction. (10 Marks)
- 4
 - a. Derive theoretical Head-Capacity (H-Q) relation in case of radial flow pump (centrifugal)

$$H = u_2^2 - \frac{u_2^2 Q \cot \beta_2}{A_2}$$

β_2 = discharge blade angle with respect to tangential direction. Explain the effect of discharge angle on it. (10 Marks)
 - b. An axial flow compressor has the following data entry conditions: 1 bar and 20°C, degree of reaction = 50%, mean blade ring diameter = 60cm, rotational speed = 18000rpm, blade angle at rotor and stator exit = 65°. Axial velocity = 180m/s, mechanical efficiency = 96.7%. Find:
 - i) Blade angle at rotor and stator inlet
 - ii) Power required to drive the compressors. (10 Marks)

- 5 a. With a neat sketch, explain the pressure-velocity compounding of steam turbine. (10 Marks)
 b. In a Curtis stage with two rows of moving blades the rotor are equiangular. The first rotor has angle of 29° each while second rotor has angle of 32° each. The velocity of steam at the exit nozzle is 530m/s and the blade co-efficients are 0.9 in the first, 0.95 in the stator and in the second rotor. If the absolute velocity at the stage exit should be axial, Find:
 i) Mean blade speed ii) Rotor efficiency iii) Power output for a flow rate of 32kg/sec. (10 Marks)
- 6 a. Derive the condition for maximum efficiency of reaction steam turbine and hence prove that

$$\eta_{b_{max}} = \frac{2\cos^2\alpha_1}{1 + \cos^2\alpha_1}$$
 (10 Marks)
 b. A Parson's turbine is running at 1200rpm. The mean rotor diameter is 1m. Blade outlet angle is 23° , speed ratio is 0.75 stage efficiency is 0.8. Find Enthalpy drop in this stage. (10 Marks)
- 7 a. Show that for a Pelton turbine the maximum hydraulic efficiency is given by

$$\eta_{max} = \frac{1 + C_b \cos\beta_2}{2}$$
 where C_b = blade velocity coefficient, β_2 = Blade discharge angle. (10 Marks)
 b. In a power station, a pelton wheel producer 15000kW under a head of 350m while running at 500rpm. Assume turbine efficiency of 0.84, coefficient of velocity for nozzle as 0.98, speed ratio 0.46 and bucket velocity coefficient 0.86. Calculate:
 i) Number of jet ii) Diameter of each jet iii) Tangential force on the buckets if the bucket deflect the jet through 165° . (10 Marks)
- 8 a. Define the following: i) Monometric Head ii) Hydraulic Efficiency iii) Mechanical Efficiency iv) Overall efficiency v) Volumetric efficiency. (10 Marks)
 b. In a Francis turbine, the discharge is radial, the blade speed at inlet is 25m/s. At the inlet tangential component of velocity is 18m/s. The radial velocity of flow is constant and equal to 2.5m/s. Water flows at the rate of $0.8\text{m}^3/\text{sec}$. The utilization factor is 0.82. Find:
 i) Euler's head ii) Power developed iii) Degree of reaction (R) iv) Inlet blade angle
 Draw the velocity triangles. (10 Marks)
- 9 a. What are the applications of multistage centrifugal pumps? With a neat sketch, explain centrifugal pumps in series and parallel. (10 Marks)
 b. A centrifugal pump working in a dock, pumps 1565//sec, against head (mean lift) of 6.1m, when the impeller rotates at 200rpm. The impeller diameter is 122cm and the area at outlet periphery is 6450cm^2 . If the vanes are set back at an angle of 26° at the outlet. Find:
 i) Hydraulic efficiency ii) Power required to drive the pump. If the ratio of external to internal diameter is 2, find the minimum speed to start pumping. (10 Marks)
- 10 a. For axial flow compressor, show that

$$E = V_r u \left[\frac{\tan\beta_2 - \tan\beta_1}{\tan\beta_1 \tan\beta_2} \right]$$
 (10 Marks)
 b. What are the types of diffuser used in centrifugal compressor? Explain any two. (10 Marks)

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17ME54

Fifth Semester B.E. Degree Examination, July/August 2021 Design of Machine Elements – I

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions.
2. Any missing data may be suitably assumed.
3. Use of design data handbook is permitted.*

- 1 a. What is Mechanical Engineering Design? Explain the steps involved in design with a block diagram. (08 Marks)
- b. A circular rod of diameter 50mm is subjected to loads as shown in Fig.Q1(b). Determine the nature and magnitude of stresses at the critical points. (12 Marks)

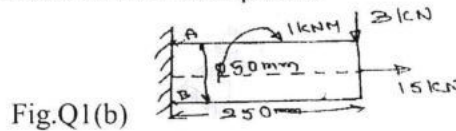


Fig.Q1(b)

- 2 a. What is stress concentration? Explain the factors affecting the stress concentration. (04 Marks)
- b. State and explain the theories of failure applicable to (i) ductile (ii) brittle material. (04 Marks)
- c. Determine the maximum stress induced in the semi circular grooved shaft shown in Fig.Q2(c), if it is subjected to (i) An axial load of 40 kN (ii) A bending moment of 400 N-m (iii) A Twisting moment of 500 N-m. Take the stress concentration into account.

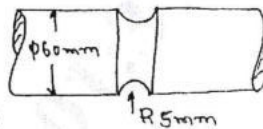


Fig.Q2(c)

(12 Marks)

- 3 a. Derive an expression for stress induced in a rod due to the axial impact of a weight 'W' dropped from a height 'h' on to a collar attached at the free end of the rod. What is the stress due to suddenly applied load? (08 Marks)
- b. A cantilever beam of span 800 mm has a rectangular cross-section of depth 200mm. The free end of the beam is subjected to a transverse load of 1 kN that drops on to it from a height of 40mm. Selecting C-40 steel ($\sigma_y = 328.6$ MPa) and factor of safety = 3, determine the width of rectangular cross section. (12 Marks)
- 4 a. Derive Soderberg's relation for a member subjected to fatigue loading. (05 Marks)
- b. Determine the maximum load for the simply supported beam, cyclically loaded as shown in Fig.Q4(b). The ultimate strength is 700 MPa. The yield point in tension is 520 MPa and the endurance limit is reversed bending is 320 MPa. Use a factor of safety of 1.25. The load, size and surface correction factors are 1, 0.75 and 0.9 respectively. (15 Marks)

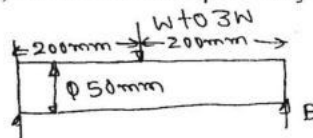


Fig.Q4(b)

- 5 A horizontal piece of commercial shafting is supported by two bearings 1.5m apart. A keyed gear 20° involute and 175 mm in diameter is located 400mm to the left of the right bearing and is driven by a gear directly behind it. A 600 mm diameter pulley is keyed to the shaft 600 mm to the right of the left bearing and drives a pulley with a horizontal belt directly behind it. The tension ratio of the belt is 3 to 1, with the slack side on top. The drive transmits 45 kW at 330 rpm. Take $k_b = k_t = 1.5$. Calculate the necessary diameter of the shaft and angular deflection in degrees. Use allowable shear stress 40 MPa and $G = 80 \times 10^9 \text{ N/mm}^2$. (20 Marks)
- 6 a. Design a Knuckle joint to transmit 150 kN. The design stress may be taken as 75 N/mm^2 in tension, 60 N/mm^2 in shear and 150 N/mm^2 in compression. (10 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 to be 20% greater than the full load torque. The allowable shear stress in the bolt is 60 MPa and the allowable shear stress in the flange is 40 MPa. (10 Marks)
- 7 a. Design a triple riveted lap joint zig-zag type, for a pressure vessel of 1.5 M diameter. The maximum pressure inside the vessel is 1.5 MPa. The allowable stresses in tension, crushing and shear are 100, 125 and 75 MPa respectively. (10 Marks)
 b. Determine the diameter of rivet for the joint shown in Fig.Q7(b). The allowable stress in the rivets is 100 N/mm^2 .

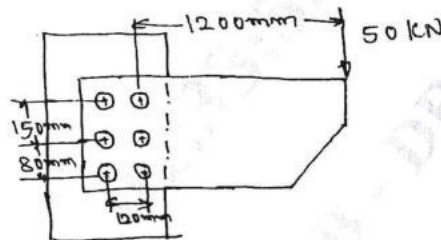


Fig.Q7(b)

(10 Marks)

- 8 a. A plate of 80 mm wide and 15 mm thick is joined with another plate by a single transverse weld and a double parallel weld. Determine the length of parallel fillet weld if the joint is subjected to both static and fatigue loading. Take $\sigma_t = 90 \text{ MPa}$, $\tau = 55 \text{ MPa}$ as the allowable stresses and stress concentration factors as 1.5 for transverse and 2.7 for parallel weld. (10 Marks)
 b. A 16 mm thick plate is welded to a vertical support by two fillet welds shown in Fig.Q8(b). Determine the size of weld, if the permissible shear stress for the weld material is 75 MPa.

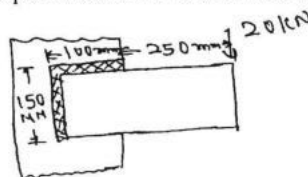


Fig.Q8(b)

(10 Marks)

- 9 a. A bracket is fixed to the wall by means of four bolts and loaded as shown in Fig.Q9(a). Calculate the size of the bolt if the load is 10 kN and allowable shear stress in the bolt material is 40 MPa.

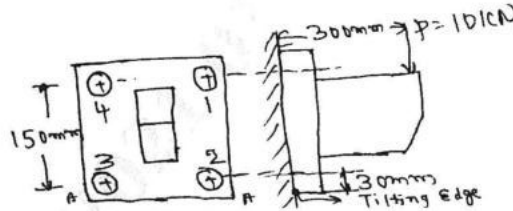


Fig.Q9(a)

(10 Marks)

- b. The structural connection shown in Fig.Q9(b) is subjected to an eccentric load P of 10 kN with an eccentricity of 500mm. The centre distance between bolts at 1 and 3 is 150mm and the centre distance between bolts 1 and 2 is 200mm. All the bolts are identical. The bolts are made of plain carbon steel having yield strength in tension of 400 MPa and the F.O.S is 2.5. Determine size of bolts.

(10 Marks)

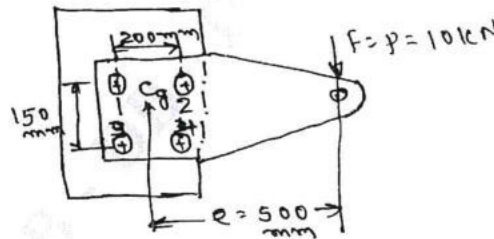


Fig.Q9(b)

- 10 a. Explain self locking and overhauling in power screws. (05 Marks)
- b. A square threaded power screw has a nominal diameter of 30mm and a pitch of 6mm with double threads. The load on the screw is 6 kN and the mean diameter of the thrust collar is 40mm. The C.O.F for the screw is 0.1 and the collar is 0.09. Determine
- Torque required to raise the screw against load.
 - Torque required to lower the screw with the load.
 - Overall efficiency
 - Is this screw self-locking.

(15 Marks)

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17ME554

Fifth Semester B.E. Degree Examination, July/August 2021 Non-Traditional Machining

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions.

- 1 a. What are the basic factors upon which the unconventional machining processes are classified? Explain. (12 Marks)
b. Justify the need of unconventional manufacturing process in today's industries. (04 Marks)
c. List the advantages and disadvantages of NTM. (04 Marks)
- 2 a. Distinguish between conventional and unconventional manufacturing process. (10 Marks)
b. Explain the parameters influencing the NTM process selection. (10 Marks)
- 3 a. What is Ultrasonic Machining? Explain the ultrasonic machining process with schematic diagram. (10 Marks)
b. Discuss the effects of :
(i) Grain size (ii) Amplitude and frequency of vibration
(iii) Applied static load (iv) Slurry
(v) Tool and work material on MRR in USM. (10 Marks)
- 4 a. Explain with schematic diagram the abrasive Jet Machining process. (08 Marks)
b. Mention any two advantages, disadvantages and applications of AJM. (06 Marks)
c. With a neat sketch explain Water Jet Machining process. (06 Marks)
- 5 a. With a neat sketch, explain the working principle of ECM process. (08 Marks)
b. Explain the process parameters of ECM. (08 Marks)
c. Differentiate ECM with conventional grinding. (04 Marks)
- 6 a. Explain the sequence of operation in chemical machining. (10 Marks)
b. Differentiate between 'Chemical Milling' and 'Chemical Blanking'. (05 Marks)
c. Discuss the factors to be considered in selection of 'Maskants' and the types that used in Chemical Machining. (05 Marks)
- 7 a. Explain the working principle of EDM with a neat sketch. (10 Marks)
b. Explain the different methods of dielectric flushing in Electric Discharge Machining. (06 Marks)
c. List the advantages and applications of EDM. (04 Marks)

- 8 a. What is Plasma Arc Machining? Explain PAM process with neat a sketch. (10 Marks)
b. What are the factors that govern the performance of PAM? Explain any one of them. (06 Marks)
c. Explain the safety precaution in PAM. (04 Marks)
- 9 a. With a neat sketch, explain the mechanism of metal removal in LBM process. (10 Marks)
b. Write a note on different types of lasers used in LBM process. (06 Marks)
c. What are the advantages and applications of Laser Beam Machining? (04 Marks)
- 10 a. With a neat sketch explain the working principle of Electron Beam Machining process. (10 Marks)
b. Comment on the parameters affecting on the machining process in EBM. (06 Marks)
c. Differentiate between LBM and EBM processes. (04 Marks)

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17ME562

Fifth Semester B.E. Degree Examination, July/August 2021 Energy and Environment

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions.

- 1 a. Discuss with relevant statistics, the world energy scenario with respect to production and consumption. (10 Marks)
b. List the various factors that affect energy development in India. Discuss any one of them. (10 Marks)
- 2 a. List the key energy trends in India. Explain any one of them with relevant statistics. (10 Marks)
b. Define energy and power. Differentiate the two. (10 Marks)
- 3 a. Discuss the need and benefits of energy storage systems. (10 Marks)
b. List the various energy storage systems. Explain with a neat sketch, the pumped storage system. (10 Marks)
- 4 a. What is energy audit? Discuss need for energy audit. (10 Marks)
b. Explain the principles of energy management. (10 Marks)
- 5 a. Explain with neat diagram, (i) Carbon cycle (ii) Oxygen cycle (10 Marks)
b. Explain with neat diagram, (i) Food chain (ii) Food web (10 Marks)
- 6 a. Write a short note on ecological succession, with a suitable example. (10 Marks)
b. Explain grass land ecosystem and its conservation. (10 Marks)
- 7 a. Discuss the causes, effects and control measure of air pollution. (10 Marks)
b. Explain the various measures of control of:
(i) Water pollution (ii) Marine pollution (10 Marks)
- 8 a. Discuss the contribution of individual in prevention of pollution. (10 Marks)
b. Discuss any two case studies related to pollution. (10 Marks)
- 9 a. What are the salient features of wild life protection act? (10 Marks)
b. What are the salient features of environmental protection act? (10 Marks)
- 10 a. Discuss in brief global warming and its effects on climate. (10 Marks)
b. Write short notes on: (i) Acid rain (ii) Ozone layer depletion (10 Marks)

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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.

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Fifth Semester B.E. Degree Examination, July/August 2021 Management & Economics

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions.

- 1 a. What is Management? Highlight the scope and functional areas of management. (10 Marks)
b. Differentiate Administration and Management. Explain briefly system approach. (10 Marks)
- 2 a. What is planning? List the purpose and objectives of planning. (10 Marks)
b. With a block diagram, explain the steps in decision making. (10 Marks)
- 3 a. List the different types of organizations and explain briefly line and staff organization with a chart. (10 Marks)
b. Write a note on any two selection techniques. (10 Marks)
- 4 a. What is motivation? Explain its characteristics. (10 Marks)
b. List and explain essentials of a sound control system. (10 Marks)
- 5 a. Which of the following is better for Decision Making Intuition (or) Analysis? Discuss and list various factors influencing demand. (10 Marks)
b. Briefly discuss about micro and macro economics demand and supply. (10 Marks)
- 6 a. What do you understand by CFD, explain with a neat sketch, CFD for borrowers and lenders point of view? (10 Marks)
b. A Bank is offering home loan of Rs.25,00,000/- to Mr.Dixit to buy a double bed room home. The rate of interest quoted is 8% compounded annually. The payback period is 14 years in equal installments. Find the EMI and Annual installments amount that Mr. Dixit has to pay to the bank. (10 Marks)
- 7 a. Define present worth method of comparison and state the conditions for present worth (PWC). (08 Marks)
b. A Industrialist wants to buy a NC machines for his factory. He has given three options from three suppliers. The initial cost, annual revenue and salvage values along with their lives are given in the table.

	Initial cost (Rs.)	Annual Revenue (Rs.)	Salvage Value (Rs.)	Life (years)
Machine 1	2.5 lakh	1 lakh	40,000/-	8
Machine 2	4.5 lakh	1.5 lakh	65,000/-	8
Machine 3	7 lakh	2 lakh	90,000/-	8

Apply present worth method and suggest which machines need to be selected by the industry and why? (12 Marks)

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.

- 8 a. Explain the following :
- (i) Internal Rate of Return and
 - (ii) External Rate of Return (08 Marks)
- b. A distinctive prototype model was developed by a company. The company has spent Rs.5 lakhs to develop this model. It is expecting a return of 7 lakhs at the end of a year. Further, it is also expecting Rs.3 lakhs for next 3 years continuously. Calculate the rate of returns for the model to the company. (12 Marks)
- 9 a. How do you determine selling price? Explain with a figure. (08 Marks)
- b. The TVS factory produces 500 mopeds in a day. This involves direct material cost of Rs.40,000/- labour cost of Rs.35,000/- and over head cost of Rs.10,000/-. The company is expecting a profit of 15% of the selling price and estimated selling over heads has 30% of factory cost. Calculate the selling price of each mopeds. (12 Marks)
- 10 a. Explain important causes for depreciation and discuss your understandings about term TAX. (08 Marks)
- b. Give the complete procedure for computing depreciation charges by sinking fund method. (12 Marks)

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Fifth Semester B.E. Degree Examination, July/August 2021 Design of Machine Elements – I

Time: 3 hrs.

Max. Marks: 100

- Note:** 1. Answer any FIVE full questions.
2. Use of data hand book is permitted.
3. Missing data should be suitably assumed and clearly stated.

- 1 a. Write brief note on general procedure used in design. (06 Marks)
 b. List the factors which govern the selection of a material for a machine component. (04 Marks)
 c. A circular rod of diameter 50 mm is subjected to loads as shown in Fig. Q1 (c). Determine the nature and magnitude of stresses at critical points 'A' and 'B'. (10 Marks)

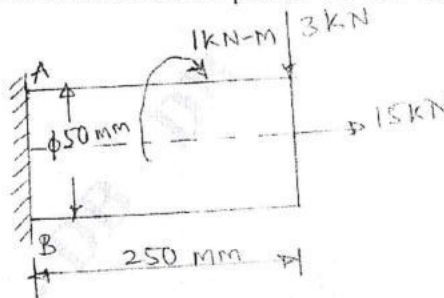


Fig. Q1 (c)

- 2 a. A mild steel shaft is subjected to 3500 N-m of bending moment at its critical point and transmits a torque of 2500 N-m. The shaft is made of steel having yield strength of 231 MPa. Estimate the size of the shaft based on the following theories of failure:
 (i) Maximum normal stress theory.
 (ii) Maximum shear stress theory.
 Take FOS = 2. (10 Marks)
 b. A rectangular plate with semi-circular groove of radius 12 mm as shown in Fig. Q2 (b) is subjected to, (i) Tensile force of 10 kN (ii) Bending moment of 15 N-m. Determine the maximum stress induced in each case. (10 Marks)

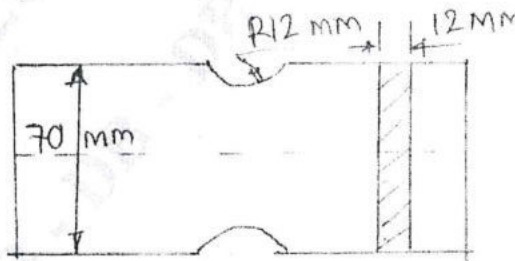


Fig. Q2 (b)

- 3 a. Derive an expression for impact stresses due to axial load. (10 Marks)
 b. A rough finished steel rod having $\sigma_U = 620$ MPa, $\sigma_y = 400$ MPa and $\sigma_{-1} = 345$ MPa is subjected to completely reversed bending moment of 400 N-m. Determine the diameter of the rod required based on factor of safety of 2.5. (10 Marks)

- 4 a. Define endurance limit. List the factors affecting endurance limit. Explain any one factor. (06 Marks)
- b. A steel member of circular cross-section is subjected to a torsional stress that varies from 0 to 35 MPa and at the same time it is subjected to an axial stress that varies from -14 MPa to $+28$ MPa. Neglecting stress concentration and column effect and assuming that the maximum stresses in torsion and axial load occur at the same time. Determine
- The maximum equivalent shear stress.
 - The design factor of safety based on yield in shear
- The material has an endurance limit $\sigma_{-1} = 206$ MPa and a yield strength of $\sigma_y = 480$ MPa. The diameter of the member is less than 12 mm. Take load concentration factor = 1, surface finish factor is equal to 1. (14 Marks)
- 5 A horizontal piece of commercial shafting is supported by two bearings 1.5 m apart. A keyed gear 20° involute and 175 mm in diameter is located 400 mm to the left of right bearing and is driven by a gear directly behind it. A 600 mm diameter pulley is keyed to the shaft 600 mm to the right of the left bearing and drives a pulley with a horizontal belt directly behind it. The tension ratio of the belt is 3 : 1, with slack side on top. The drive transmits 45 kW at 330 rpm. Take $C_M = C_t = 1.5$. Calculate the necessary shaft diameter and angular deflection in degrees. Use allowable shear stress of 40 MPa and $G = 80$ GPa. (20 Marks)
- 6 a. Find the length of square key of size $\frac{d}{4}$ such that the shaft and the key are made up of same material. (06 Marks)
- b. Design a protective CI flange coupling for a steel shaft transmitting 15 kW at 200 rpm and having an allowable shear stress of 40 MPa. The working stress in the bolt should not exceed 30 MPa. Assume that the same material is used for shaft and key and the existing stress is twice its value in shear stress. The maximum torque is 25% greater than the full load torque. The shear stress for CI is 14 MPa. (14 Marks)
- 7 a. Design a double riveted butt joint with two cover plates for the longitudinal beam of a boiler shell 1.5 m in diameter subjected to a steam pressure of 0.95 N/mm². Assume an efficiency of 75% allowable tensile stress in the plate of 90 MPa allowable compressive stress of 140 MPa and an allowable shear stress in the rivets as 56 MPa (Assume chain riveting). (10 Marks)
- b. For the riveted joint shown in Fig. Q7 (b), determine the size of the rivet taking permissible shear stress in rivets as 60 MPa. (10 Marks)

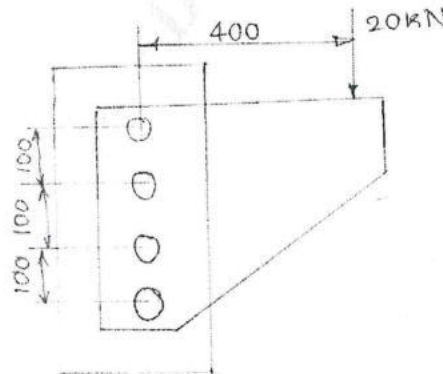


Fig.Q7 (b)

- 8 a. A 80 mm wide, 12 mm thick plate carrying an axial load of 96 kN is welded to a support as shown in Fig. Q8 (a). The following tensile and shear stress in the weld are 100 MPa and 70 MPa respectively. Find the length of each parallel fillet weld. (10 Marks)

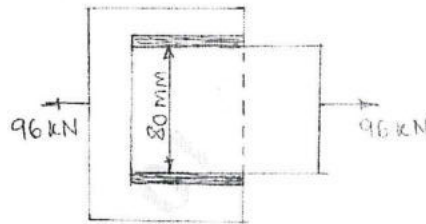


Fig. Q8 (a)

- b. A shaft of rectangular cross section is welded to a support by means of fillet welds as shown in Fig. Q8 (b). Determine the size of the welds, if permissible shear stress in the weld is limited to 75 MPa. (10 Marks)

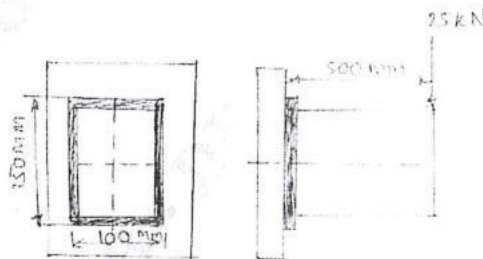


Fig. Q8 (b)

- 9 a. Design a socket and spigot type cotter joint to sustain an axial load of 100 kN. The material selected for the joint has the following design stresses. $\sigma_t = 100$ MPa, $\sigma_c = 150$ MPa and $\tau = 60$ MPa. (10 Marks)
- b. A M20 \times 2 steel bolt of 100 mm is subjected to impact load. The energy absorbed by the bolt is 2 N-m.
- Determine the stress in the shank of the bolt. If there is no thread portion between the nut and bolt head.
 - Determine the stress in the shank, if the entire length of the bolt is threaded.
- Assume modulus of elasticity for steel as 206 GPa. (10 Marks)
- 10 a. What is self locking of a power screw? Derive an equation for torque required to raise the load on a square thread. (10 Marks)
- b. The lead screw of a machine has single start trapezoidal threads of 30 mm outside diameter and 6 mm pitch. It drives the tool carriage against an axial load of 1500 N. The thrust collar has a mean diameter of 40 mm. The carriage is moved at a speed of 0.72 m/sec. The co-efficient of friction for both screw and collar is 0.14. Find the power required to drive the screw and the efficiency. (10 Marks)

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Fifth Semester B.E. Degree Examination, July/August 2021 Dynamics of Machines

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions.

- 1 a. Discuss the static equilibrium of
- i) Two forces
 - ii) Three forces
 - iii) Member with two forces and a torque. (06 Marks)
- b. A four bar mechanism under the action of two external forces is shown in Fig.Q.1(b). Find the required input torque on the link AB for static equilibrium. The dimensions of the links are AB = 50mm, BC = 66mm, CD = 55mm, CE = 25mm, CF = 30mm, angle BAD = 60° and AD = 100mm. (14 Marks)

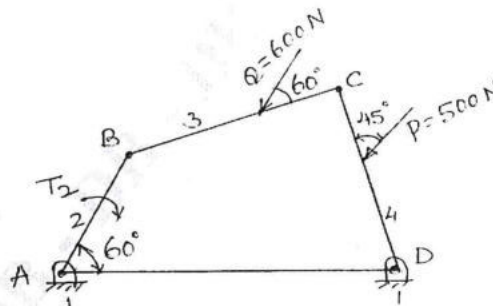


Fig.Q.1(b)

- 2 a. Explain in brief D'Alembert's principle and state why it is used. (06 Marks)
- b. The piston diameter of an internal combustion engine is 125mm and the stroke is 220mm. The connecting rod is 4.5 times the crank length and has a mass of 50kg. The mass of the reciprocating parts is 30kg. The centre of mass of the connecting rod is 170mm from the crank pin centre and the radius of gyration about an axis through the centre of mass is 148mm. The engine runs at 320rpm. Find the magnitude and the direction of the inertia force and the corresponding torque on the crank shaft when the angle turned by the crank is 140° from the inner dead centre using Analytical method. (14 Marks)
- 3 a. Explain static balance and dynamic balance as applied to revolving masses in different planes. (04 Marks)
- b. A shaft carries three masses in planes A, B and C. Planes B and C are 600mm and 1200mm from plane A. Masses in planes A, B and C are 50kg, 40kg and 60kg respectively at a radius of 25mm. The angular position of mass B and C with A are 90° and 210° respectively. Find the unbalanced force and couple if the shaft revolves at 300rpm. Also find the position and magnitude of balancing mass required at 100mm radius in planes "L" and "M" midway between A and B between B and C. (16 Marks)

- 4 a. Explain the terms primary balancing and secondary balancing as used for balancing of reciprocating masses. **(05 Marks)**
- b. A four cylinder vertical engine has cranks 300mm long. The planes of rotation of first, third and fourth crank are 750mm, 1050mm and 1650mm respectively from that of the second crank and their reciprocating masses are 150kg, 400kg and 250kg respectively.
- Find the mass of the reciprocating parts for the second cylinder and the relative angular positions of the cranks in order that the engine may be complete primary balance.
 - If each connecting rod of all four cylinders is 1.35m long and the speed is 300rpm find maximum unbalanced secondary force and couple and crank positions at which maximum unbalanced secondary force and couple occur. **(15 Marks)**
- 5 a. Derive an expression for speed of a porter governor with usual notations taking friction in to account. **(10 Marks)**
- b. In a Hartnell Governor the length of ball and sleeve arms are 12 and 10cm respectively. The distance of fulcrum of the bell crank lever from the governor axis is 140mm. Mass of each governor ball is 4kg. When the governor runs at the mean speed of 300rpm, the ball arm is vertical and sleeve arm is horizontal. For an increase of speed of 4% the sleeve moves 10mm upward. Neglecting friction, find:
- Minimum equilibrium speed if total sleeve movement is 20mm.
 - Spring stiffness
 - Sensitiveness of Governor
 - Spring stiffness if Governor is to be isochronous at 300rpm. **(10 Marks)**
- 6 a. Analyze the stability of a two wheel vehicle taking left turn. Derive the necessary equations. **(10 Marks)**
- b. A ship is propelled by a turbine rotor which has a mass of 2500 kg and has a speed of 3200rpm clockwise direction when viewed from stern. The rotor has a radius of gyration of 0.4m. Determine the gyroscopic couple and its effect when.
- The ship steers to the left in a curve of 80m radius at a speed of 15 knots (1 knot = 1860 m/h).
 - The ship pitches 5 degrees above and 5 degrees below the normal position and the bow is descending with its maximum velocity. The motion due to pitching is simple harmonic motion and the periodic time of 40 seconds.
 - The ship rolls and at the instant, its angular velocity is 0.04 rad/sec clockwise when viewed from stern.
 - Also find the maximum angular acceleration during pitching. **(10 Marks)**
- 7 a. Briefly explain with neat sketches of Free, Forced, damped, undamped, longitudinal vibrations. Transverse and Torsional vibrations. **(10 Marks)**
- b. Determine the equation of motion and the natural frequency of the system shown in Fig.Q.7(b), by using Newtons method and energy method. **(10 Marks)**

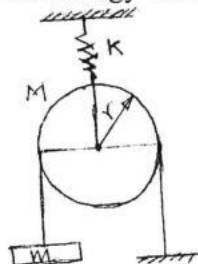


Fig.Q.7(b)

- 8 a. Define logarithmic decrement and derive the equation for same. (10 Marks)
 b. A body of mass 7.5kg is suspended from a helical spring and makes damped oscillations. The time for 60 oscillation is 35sec and ratio of first to seventh displacement is found to be 2.5. Find: i) Stiffness of spring ii) Logarithmic decrement iii) Damping factor iv) Damping resistance and v) If the oscillations were critically damped, what is the damping resistance? (10 Marks)
- 9 a. Derive an expression for steady state amplitude of vibration of mass in a spring mass damper system, when the mass is subjected to harmonic excitation. (10 Marks)
 b. A machine supported symmetrically on four springs has a mass of 80kg. The mass of the reciprocating parts is 2.2kg which move through a vertical stroke of 100mm with simple harmonic motion. Neglecting damping, determine the combined stiffness of the springs so that the force transmitted to the foundation is $\frac{1}{20}$ th of the impressed force. The machine crank shaft rotates at 800rpm. If under actual working conditions, the damping reduces the amplitudes of successive vibrations by 30%, find the
 i) Force transmitted to the foundation at 800rpm.
 ii) Force transmitted to the foundation at resonance.
 iii) Amplitude of the vibrations at resonance. (10 Marks)
- 10 a. Derive an expression for the natural frequency of free transverse vibrations for a simply supported beam or shaft carrying several loads by using
 i) Dunkerley's method
 ii) Energy method. (10 Marks)
 b. The following data relate to a shaft held in long bearings:
 Length of shaft = 1.2m
 Diameter of shaft = 14mm
 Mass of a rotor at mid point = 16kg
 Eccentricity of centre of mass of rotor from centre of rotor = 0.4mm
 Modulus of elasticity of shaft material = 200GN/m^2
 Permissible stress in shaft material = $70 \times 10^6\text{N/m}^2$
 Determine the critical speed of the shaft and the range of speed over which it is unsafe to run the shaft. Assume the shaft to be massless. (10 Marks)

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Fifth Semester B.E. Degree Examination, July/August 2021 Turbo Machines

Time: 3 hrs.

Max. Marks: 100

Note : 1. Answer any FIVE full questions.

2. Use of Steam table and Mollier chart are allowed.

1.
 - a. With a neat sketch, mention the parts of a Turbo machine. (04 Marks)
 - b. Differentiate Turbo machine with Positive displacement machine. (06 Marks)
 - c. A model of Kaplan turbine one tenth of the actual size is tested under a head of 5m when the actual head for the prototype is 8.5m. The power developed by the prototype turbine is 8000 kW when running at 120 rpm at an overall efficiency of 85%. Determine
 - i) Speed
 - ii) Discharge
 - iii) Power developed
 - iv) Specific speed of the model. (10 Marks)

2.
 - a. With the help of h-s diagram, explain the efficiency of power generating type turbo machines. (08 Marks)
 - b. A 16 stage axial flow compressor is to have a pressure ratio of 6.3 and the stage efficiency of 89.5%. The intake conditions are 288K and 1 bar. Determine
 - i) Overall efficiency
 - ii) Polytropic efficiency
 - iii) Preheat factor. (12 Marks)

3.
 - a. Define the Degree of Reaction and Utilisation factor. Establish the relationship between them. (08 Marks)
 - b. The velocity of steam outflow from a nozzle in a impulse turbine is 1200 m/s. The nozzle angle being 22° . If the rotor blades are equiangular and the diameter of runner is 3.5m and rotating with the speed of 2180 rpm. Determine
 - i) Blade angles
 - ii) Tangential force on the blade ring
 - iii) Power output and
 - iv) Utilization factor. Assume $V_{r1} = V_{r2}$. (12 Marks)

4.
 - a. Show that the degree of reaction for axial flow machine is given by

$$R = \frac{V_f [\tan \beta_1 + \tan \beta_2]}{2u [\tan \beta_1 + \tan \beta_2]}$$
 , where V_f = Velocity of flow. β_1 and β_2 are inlet and outlet blade angles. (10 Marks)
 - b. Show that the degree of reaction for Radial outward flow turbo machine is given by

$$R = \frac{2 + \cot \beta_2}{4}$$
 , where β_2 = Blade angle at the exit. (10 Marks)

5.
 - a. What do you mean by Compounding of Steam turbine? Explain two methods of Compounding. (08 Marks)
 - b. Steam issuing from a nozzle to a De – Laval turbine with a velocity of 1000 m/s. The nozzle angle is 20° , the mean blade speed is 400m/s. The blades are symmetrical. The mass flow rate is 1000 kg/hr, Friction factor is 0.8 , Nozzle efficiency = 0.95. Taking the scale of 1:100, find the following Graphically :
 - i) Blade angles
 - ii) Axial thrust
 - iii) Work done per kg of steam
 - iv) Power developed
 - v) Blade efficiency
 - vi) Stage efficiency. (12 Marks)

- 6 a. What is Reheating in Steam turbine? List the advantages and disadvantages of reheating. (08 Marks)
- b. A 20 stage Parson's turbine receiver steam at 15 bar and 300°C and the steam leaves the turbine at 0.1 bar. The turbine has a stage efficiency of 80% and the reheat factor is 1.06. The total power developed by the turbine is 10658 kW. Find the steam flow rate through the turbine. If the blade exit angle is 25°, speed ratio is 0.75 and density of steam is 0.59 kg/m³. Find the mean diameter of the stage and rotor speed. Assume the height of the blade is equal one twelfth of the mean diameter. (12 Marks)
- 7 a. Show that the maximum hydraulic efficiency for a Pelton turbine is given by

$$\eta_h = \frac{1 + K \cos\beta}{2}$$
, where K = Bladelevel coefficient, β = Nozzle angle. (08 Marks)
- b. A double jet Pelton wheel is required to generate 7500 kW, when the available head at the base of the nozzle is 400m. The jet is deflected through 165° and the relative velocity of the jet is reduced by 15% in passing over the buckets. Determine
 i) Diameter of jet ii) Total flow iii) Force exerted by the jet in the tangential direction (12 Marks)
- 8 a. Sketch and explain the construction and working of Francis turbine. (06 Marks)
- b. What is Draft Tube? Explain the types and functions of the draft tubes. (06 Marks)
- c. A Kaplan turbine working under a head of 15m develops 7350 kW. $D_o = 4m$, $D_h = 2m$. The guide blade angle is 30°. The hydraulic efficiency and overall efficiency of the turbine are 90% and 85% respectively. If the velocity of the Whirl at outlet is zero, find i) Runner Vane angles ii) Speed of the turbine iii) Specific speed of the turbine. (08 Marks)
- 9 a. With reference to Centrifugal pump, define the following :
 i) Static head ii) Delivery head iii) Manometric head
 iv) Manometric efficiency v) Net Positive suction head. (08 Marks)
- b. Derive the expression for minimum starting speed of a centrifugal pump. (06 Marks)
- c. A centrifugal pump with impeller outside diameter of 200mm and rotates at 2900 rpm. The vanes are curved back at 25°. The velocity of flow is constant at 3m/s. Assuming the hydraulic efficiency at 75% and determine the head generated. Also determine the power required to run the impeller if the breadth of the wheel at the outlet is 15mm. (06 Marks)
- 10 a. Define the Slip and Slip coefficient in Centrifugal Compressor. Also explain the effect of slip in the Centrifugal Compressor. (06 Marks)
- b. Explain the Surging and Choking in Centrifugal Compressor. (06 Marks)
- c. A Centrifugal Compressor has an inlet eye 15cm diameter. The impeller revolves at 20000 rpm and the inlet air has an axial velocity of 107 m/s, inlet stagnation temperature and pressure are 294 K and 1.03 bar respectively. Determine
 i) Inlet Blade angle ii) Mach number. (08 Marks)

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CBCS SCHEME

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18ME55

Fifth Semester B.E. Degree Examination, July/August 2021 Fluid Power Engineering

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions.

- 1**
- Define fluid power technology. Mention the advantages and applications of fluid power system. (06 Marks)
 - What is Pascal's law? Explain the concept of force multiplication. (06 Marks)
 - Write notes on:
 - Sealing materials
 - Pressure drop in hoses/pipes (08 Marks)
- 2**
- Explain the desirable properties of hydraulic fluids in industrial hydraulic systems. (08 Marks)
 - Explain the various filter locations used in filtering in hydraulic systems. (06 Marks)
 - Write a note on hoses and quick acting couplings. (06 Marks)
- 3**
- With a neat sketch, explain the construction and working of variable displacement vane pump. Also mention the difference between positive and non positive displacement pumps. (10 Marks)
 - Write a note on performance characteristics of gear pump. (05 Marks)
 - Explain briefly the gas loaded type of accumulator with a neat sketch. (05 Marks)
- 4**
- Explain the working of cushioning and telescopic cylinders with a neat sketch with suitable applications. (10 Marks)
 - A hydraulic motor has a volumetric displacement of $123 \times 10^{-6} \text{ m}^3$. If it receives $0.0009 \text{ m}^3/\text{s}$ of oil at 50 bars, find:
 - Speed of the motor
 - Theoretical torque
 - Theoretical power of the motor (06 Marks)
 - Mention the difference between:
 - Hydraulic pump and hydraulic motor
 - Linear Actuator and Rotary Actuator (04 Marks)
- 5**
- Give the classification of control valves. Also explain the different centre positions of 3 position 4 way direction control valves with symbolic representations. (09 Marks)
 - Discuss the working of pressure compensated flow control valve with a neat sketch. (06 Marks)
 - Give the symbolic representation of:
 - Pressure relief valve
 - Pressure reducing valve (05 Marks)
- 6**
- Explain the following with a neat hydraulic circuits:
 - Force Multiplication Circuit
 - Sequencing Circuit (16 Marks)
 - Explain the speed control of hydraulic cylinder involved with meter-in circuit. (04 Marks)

- 7 a. Discuss the structure of pneumatic control system with the aid of block diagram. Also mention the limitations of pneumatic system. (08 Marks)
b. List the characteristics of compressed air in pneumatic systems. (06 Marks)
c. Explain in brief FRL Unit with a neat diagram. (06 Marks)
- 8 a. Explain the working principles of the following pneumatic cylinders with neat sketches:
(i) Impact cylinder
(ii) Rodless cylinders (08 Marks)
b. Explain the following with neat sketches:
(i) Quick Exhaust Valve
(ii) Time Delay Valve
(iii) Shuttle valve (12 Marks)
- 9 a. Explain the direct and indirect actuation of cylinders in pneumatic systems with simple circuits. (06 Marks)
b. Explain the following pneumatic circuits:
(i) Supply Air Throttling (06 Marks)
(ii) Exhaust Air Throttling (08 Marks)
c. Explain the OR Gate logic with truth table and symbol. (08 Marks)
- 10 a. Discuss the motion control diagram for a 2-cylinder circuit. (12 Marks)
b. Explain the use of relays in electro-pneumatic control. (08 Marks)

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CBGS SCHEME

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18ME56

Fifth Semester B.E. Degree Examination, July/August 2021 Operations Management

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions.

- 1 a. What do you understand by the term Operations Management? Trace the historical events leading to study of operation management. (07 Marks)
- b. Explain productivity. State the factors affecting productivity. (05 Marks)
- c. A company has an order for a particular component is 100,000 units. There are two alternate methods to manufacture the product. The details of various costs are given below:

Investment details	A	B
(i) Investment on Machinery & Building	Rs.60,00,000	Rs.80,00,000
(ii) Other Fixed & production overheads	Rs.3,00,000	Rs.2,00,000
(iii) Variable production cost/unit	Rs.125	Rs.115
(iv) Variable selling expenses/unit	Rs.5	Rs.15
Selling price/unit	Rs.280	

- (i) Which alternative is economical? (08 Marks)
- (ii) Estimate the loss of selecting wrong alternative. (08 Marks)
- 2 a. Explain the concept of production system with a schematic diagram. (07 Marks)
- b. Sketch and explain the BEP analysis. Explain how it helps in decision analysis. (05 Marks)
- c. A milk factory seeks advice concerning its business and production processes. The final report describes several steps to increase productivity. Accordingly following are the details:

	Existing system	Proposed system
Milk output/hour	1000 gallons	1400 gallons
Wage rate/hour	Rs.12	Rs.12
Filtration cost/hour	Rs.120	Rs.170
Workers	12	9

- (i) Calculate labor productivity for both systems. (08 Marks)
- (ii) Find All Factor (AFP) for both systems. (08 Marks)
- 3 a. What Forecasting? Explain any two techniques. (07 Marks)
- b. Explain any two Forecast Errors. (05 Marks)
- c. The manager of a road transport company believes that the demand for tyres used on his trucks is closely related to the number of kilometers driven. Accordingly the following data covering past 7 months collected.

Duration	1	2	3	4	5	6	7
Kms driven in 1000	120	135	130	150	170	190	220
No. of tyres used	9.5	11.0	12.0	12.5	14.0	16.0	18.0

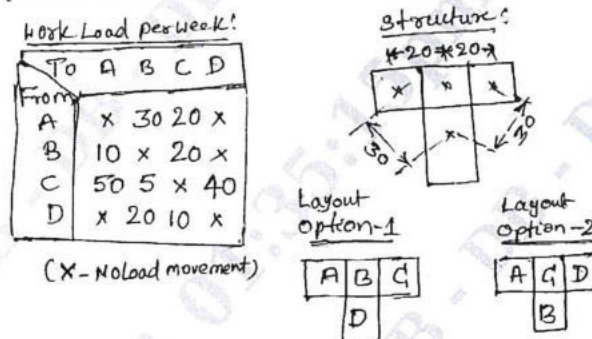
- (i) Compute the coefficients a and b for the regression line. (08 Marks)
- (ii) Suppose the manager pans to drive 250000 kms, what is the expected number of tyres which will be used? (08 Marks)

- 4 a. What is coefficient of correlation? Explain tracking signal with a graph. (06 Marks)
 b. What are the Time Series Components? Explain the processing steps in forecasting and limitations. (06 Marks)
 c. Explain the difference between MA and EMA. Find the Weighted Moving Average of 3 and 5 months.

Months	Jan	Feb	Mar	Apr	May	Jun	Jul
Bottles	1325	1353	1305	1275	1210	1195	?

(08 Marks)

- 5 a. What are the various types of capacity? Explain the importance of capacity planning. (06 Marks)
 b. Explain any two types of layout. (06 Marks)
 c. A metal processing firm wishes to install enough automobile molders to produce 250000 good castings per year. The molding operations takes 1.5 minutes per casting, but output is typically about 3% defective. How many molders will be required if each one is available for 2000 hours (of capacity) per year? (08 Marks)
- 6 a. List the various factors influencing plant location. Explain. (06 Marks)
 b. Explain the various capacity measures. What are the capacity strategies? (06 Marks)
 c. In a small factory two alternate layouts are to handle the following work load/week. Find the suitable option and optimum cost. (08 Marks)



- 7 a. What is Aggregate Planning? Explain its strategies. (06 Marks)
 b. What are the Functions of Master Production Schedule? State the difference between AP and MPS. (06 Marks)
 c. A manufacturing plant is in the process of updating its MPS for its products. The plant produces a product on a produce-to-stock basis. Table below shows the estimates of demand for the product for the next six weeks.

Types of Demand	Week					
	1	2	3	4	5	6
Customer forecast & orders	700	1200	700	500	400	1200
Warehouses	100	100	400	500	200	100
Market Research	-	50	-	-	10	-
Production Research	10	-	-	-	-	-

The plant starts with Beginning Inventory of 1500 units, the safety stock requirement of each week is 500 units and the minimum production. Lot size is 2000 units. Prepare a six week detailed master production schedule. Also Available-To-Promise for next 7th week.

(08 Marks)

- 8 a. Explain the Master Production Schedule with a diagram. (06 Marks)
 b. What are the objectives and strategies of MPS? (06 Marks)
 c. Given the following information, set the aggregate planning problem as a transportation problem and find the solution using least cost method.

Forecast demand and production capacity:

Period	Available capacity units			Demand Forecast units
	RT	OT	SG	
1	500	50	120	520
2	500	50	120	720
3	500	50	100	750

Initial Inventory = 100 units, Final Inventory = 100 units, Inventory Carrying Cost = Rs.1/unit/period. Back ordering is not permitted. (08 Marks)

- 9 a. What are the objectives of MRP? Explain the input and outputs of MRP package. (06 Marks)
 b. Explain the key features of MRP system. (06 Marks)
 c. A company makes Q model from components R, S and T. Component R is made from 2 units of component X and 1 unit of component Y. Component T is made from 1 unit of component Y and 3 units of component Z.
 (i) Draw the product structure tree for Q.
 (ii) Actually company plans to build 100 units of Q, and having inventory of 150 units of T and 200 units of R. Find the gross and net requirements of T, R and S. (08 Marks)
- 10 a. Define supply chain. What are the key decisions in supply chain? (06 Marks)
 b. Explain a typical supply chain system with a blank diagram. (08 Marks)
 c. Explain Bullwhip effect. What are the root causes for bullwhip effect? (06 Marks)

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