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18ME51

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021 Management and Economics

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Define meaning of management and explain characteristics of management. (06 Marks)
b. Discuss different levels of management. (06 Marks)
c. Briefly explain the early management approaches. (08 Marks)

OR

- 2 a. Discuss the importance and purpose of planning process. (10 Marks)
b. With the help of block diagram, explain hierarchy of plans. (10 Marks)
c.

Module-2

- 3 a. List and explain in brief the principles of organization. (14 Marks)
b. Discuss the need of committees in an organization with classification. (06 Marks)

OR

- 4 a. Explain in brief different leadership styles. (10 Marks)
b. Explain the essentials of a good sound control system. (10 Marks)

Module-3

- 5 a. Engineers are now expected not only to generate novel technological solutions but also to make skillful financial analysis of the effects of implementation. Discuss. (06 Marks)
b. State and explain the law of supply is demand mentioning the factors influencing it. (08 Marks)
c. Find the effective rate of interest for an actual rate of interest of 10% when compounded:
(i) yearly (ii) biannually (iii) quarterly
(iv) monthly (v) daily (vi) hourly (06 Marks)

OR

- 6 a. Explain time value of money assuming amount of your choice and draw the cash flow diagram. (08 Marks)
b. A 45 year old person is planning for his retired life. He plans to direct Rs.30,000 from his bonus as investment every year for the next 15 years. The bank gives 12% interest rate compounded annually. Find the maturity value of his account when he is 60 years. (04 Marks)
c. A person wants to gift a car to his daughter when she would turn 18 years, six years from now. He decides to put away money in her name during her next six birthdays. He wants to deposit Rs.25,000 in the year to go on increasing it by Rs.5000 every year for the next 6 years. If he estimates that a car would cost Rs. 5 lakhs when he wants to buy one, how much more money should be added to the maturity amount that he receives from the bank if it assumed at 11.5% compounded annually. (08 Marks)

1 of 2

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

Module-4

- 7 a. Two holiday cottages are under consideration. Compare the present worth of the cost of 24 year service, at an interest rate of 5% when neither cottage has a realizable cottage value.

	Cottage 1	Cottage 2
First cost	Rs.4500	Rs.10,000
Estimate life	12 years	24 years
Annual maintenance cost	Rs.1000	Rs.720

- b. An investor can make three end of the year payments of Rs.15000 which are expected to generate receipts of Rs.10,000 at the end of the year 4 that will increase annually by Rs.2500 for the following 5 years. If the investor can earn a rate of return of 10% on the other 8 year investments in this alternative attractive? (10 Marks)

OR

- 8 a. Define the following terms: (i) MARR (ii) IRR (iii) ERR. What are the clues of IRR calculations? (10 Marks)
- b. Rs.10 crores was generated by the management of an engineering college for the construction of its new mechanical science block. Annual maintenance of the block is estimated to be Rs.10 lakh. In addition Rs.12 lakh will be needed every 10 years for painting and Hoyer repairs. If the budget granted has to take care of perpetual maintenance, how much of the amount can be used for initial construction costs? Deposited funds can earn 6% rate of interest compounded annually. Assume that taxes and inflation do not come into picture. (10 Marks)

Module-5

- 9 a. List and explain five methods of depreciation. (10 Marks)
- b. Discuss the various causes of depreciation. (05 Marks)
- c. A high-tech bus was initially bought for Rs.50 lakhs. Its salvage value after 5 years of service would be 10 lakh. In its life time it can be driven for a distance of 10 lakhs kms in its 5th year of operation. If it has already traveled a total distance of 8 lakh kms, find the depreciation of the bus at the point. (05 Marks)

OR

- 10 a. Explain how selling price is determined for product with a block diagram. (06 Marks)
- b. Computers purchased by a public utility cost Rs.7000 each, past records indicate that they have useful life of 5 years, after which they will be disposed off, with no salvage value. The company currently has capital of 7%. Determine the following by using straight line method.
- Depreciation charges per year
 - Depreciation reserve accumulated at the end of 3rd year.
 - Book value at the end of third year.
- (06 Marks)
- c. The original assets of the company are Rs.5,80,000. The life of the plant is 9 years. If the scrap value of the time is expected to be 80,000. Calculate the depreciation at the end of each year by sum of the year method. (08 Marks)

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18ME52

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

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Discuss about the Design Process. (05 Marks)
b. List different standards and design code. (05 Marks)
c. The state of stress at a point in a strained material is as shown in Fig. 1(c). Determine:
i) Direction of the principal planes
ii) The magnitude of principal stresses
iii) The magnitude of the maximum shear stresses its direction. (10 Marks)

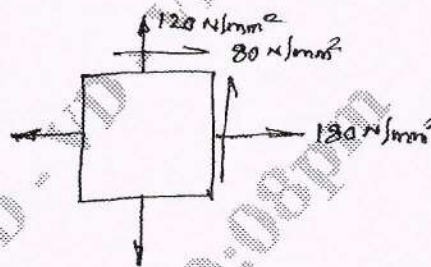


Fig. Q. 1(c)

OR

- 2 a. Define stress concentration factor and discuss about the methods to reduce stress concentration factors. (08 Marks)
b. Discuss about the following theories of failure:
i) Maximum shear stress theory
ii) Distortion energy theory. (04 Marks)
c. A flat bar, shown in Fig. Q. 2(c) is subjected to an axial load of $5 \times 10^3 \text{ N}$. Assuming the stress in the bar limited to 400 N/mm^2 , determine the thickness of the bar. (08 Marks)

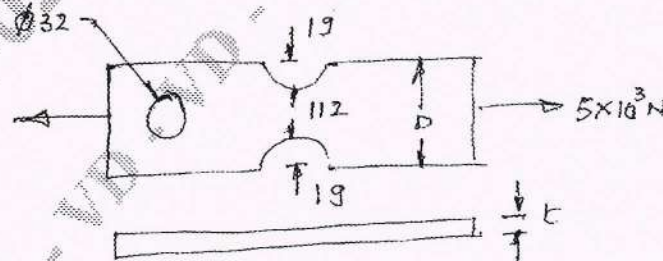


Fig. Q. 2(c)

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Module-2

- 3 a. Derive an equation for impact stress. When component is subjected to an axial load? (06 Marks)
- b. A beam of 300mm depth "I" section is resting on two supports 5m apart. It is loaded by a weight of 5000N falling through a height "h" and striking the beam at midpoint. Moment of inertia of the section is $9.6 \times 10^7 \text{ mm}^4$, assuming $E = 21 \times 10^4 \text{ N/mm}^2$. Investigate and suggest the permissible value "h" if the stress is limited to 130 N/mm^2 . (10 Marks)
- c. With a neat sketch, explain different types of varying stresses. (04 Marks)

OR

- 4 a. Discuss about the Solderberg equation for designing member subjected to fatigue loading. (06 Marks)
- b. A cold drawn steel rod of circular cross section is subjected to a variable bending moment of 565Nm to 1130Nm as the axial load varies from 4300N to 13500N. The maximum bending moment occurs at the same instant as that of axial load is maximum. Determine the required diameter of the rod for FOS is 2. Neglect stress concentration and column effect. Take $\sigma_u = 550 \text{ MPa}$, $\sigma_y = 470 \text{ MPa}$ endurance limit as 50% of the ultimate strength and size. Load and surface correction co-efficients as 0.85, 1 and 0.85 respectively. (14 Marks)

Module-3

- 5 A steel solid shaft. 1m long supported between two bearings has two gears keyed to it. The pinion having 40 teeth of 5mm module is located 200mm to the right of the left hand side bearing and receiver 20kW power at 1000rpm from a gear mounted directly below it. The another gear having 50 teeth of 8mm module is located at a distance of 400mm to the left of the right hand bearing and delivers power to another gear mounted directly behind it. The gears are $14\frac{1}{2}^\circ$ involute tooth form. The shaft rotates clockwise as seen from the left bearing. If the shaft material selected has an ultimate strength of 500MPa and yield point of 310MPa, determine the necessary diameter of the shaft using combined shock and fatigue factor for bending and twisting as 2 and 1.5 respectively. Neglect the weight of gears. (20 Marks)

OR

- 6 a. With neat sketch, explain different types of keys. (04 Marks)
- b. A shaft is required to transmit 16kW at 500rpm. Select a suitable key of rectangular cross-section, if the hub length is 60mm. Take allowable shear and crushing stresses for material used as 72MPa and 140MPa respectively. (06 Marks)
- c. Design a rigid flange coupling to transmit 18kW at 1440rpm the allowable shear stress for CI flange is 4MPa. The shaft, key and Bolts are made of annealed steel having allowable shear stress of 93MPa. Allowable crushing stress for key is 186MPa. (10 Marks)

Module-4

- 7 a. Explain with neat sketch about the failures in rivets. (06 Marks)
- b. An air vessel of 1m diameter has longitudinal triple riveted lap-joint [zig-zag type], the maximum air pressure in the vessel is 2MPa. Design the riveted joint if the safe working stress in tension, shear and crushing are 125MPa, 90MPa and 165MPa. (14 Marks)

OR

- 8 a. A shaft of rectangular cross section is welded to a support by means of fillet welds, as shown in Fig. Q.8(a). Determine the size of the welds, if the permissible shear stress in the weld is limited to 75N/mm^2 . (10 Marks)

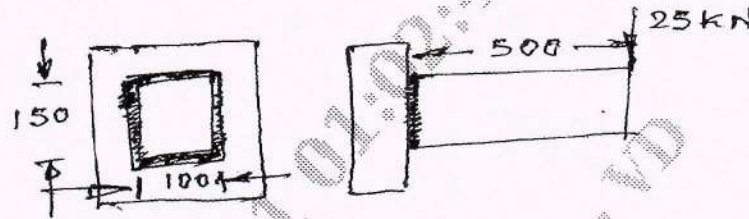


Fig. Q.8(a)

- b. A plate of 80mm wide and 10mm thick is to be welded to another plate by means of parallel fillet welds. The plates are subjected to a load of 50kN. Find the length of weld so that maximum stress does not exceed 50N/mm^2 . Consider the joint under static loading and then under dynamic loading. (10 Marks)

Module-5

- 9 a. Explain self locking and over hauling in power screws. (06 Marks)
 b. Design a sleeve type cotter joint. Connected to a two tie rod, subjected to an axial pull of 60kN. The allowable stress of c-30 material used for the rod are $\sigma_t = 65\text{N/mm}^2$, $\sigma_c = 75\text{N/mm}^2$ and $t = 65\text{N/mm}^2$. Cast steel for the sleeve has the allowable stresses of $\sigma_t = 70\text{N/mm}^2$, $\sigma_c = 110\text{N/mm}^2$ and $t = 45\text{N/mm}^2$. (14 Marks)

OR

- 10 Design a screw jack with a lift of 300mm to lift a load of 50kN. (20 Marks)

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18ME53

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021

Dynamics of Machines

Time: 3 hrs.

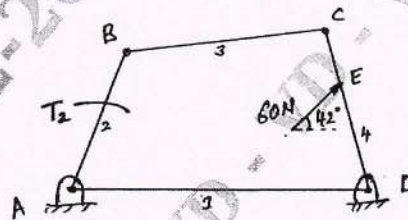
Max. Marks: 100

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

Module-1

- 1 For the static equilibrium of the four bar mechanism shown in Fig. Q1, determine the input torque T_2 on the link AB for a force of 60N acting on link CD. Dimensions are AB = 500mm, BC = 660 mm, CD = 560mm, Fixed link AD = 1000mm, DE = 373mm. (20 Marks)

Fig. Q1



OR

- 2 a. State the condition of equilibrium of a body subjected to a system of
i) two force ii) two forces and a torque. (06 Marks)
b. In a vertical engine, the length of connecting rod is 4.5 times the crank. The mass of reciprocating parts is 120kg and the crank length is 220mm. The engine runs at 250 rpm. The 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) Net effective driving force on the piston ii) Thrust on connecting rod iii) Thrust on the bearings iv) Turning moment on the crank shaft. (14 Marks)

Module-2

- 3 a. Explain Static and Dynamic balancing of rotating masses. (06 Marks)
b. A shaft carries four masses of magnitude 200kg, 300kg, 240kg and 260kg with corresponding radii of rotation are 0.2m, 0.15m, 0.25m and 0.3m respectively. The angles between the successive masses are 45° , 75° and 135° respectively. Find the magnitude and position of the balance mass required at a radius of 0.2m. (14 Marks)

OR

- 4 The firing order in a six cylinder four stroke in - line engine is 1 - 4 - 2 - 6 - 3 - 5. The piston stroke is 100mm and length of each connecting rod is 200mm. The pitch of the cylinder center lines are 100mm, 100mm, 150mm, 100mm and 100mm respectively. The reciprocating mass per cylinder is 1kg and the engine runs at 3000 rpm. Determine the unbalanced primary and secondary forces and couples, if any. Take central plane of the engine as reference plane. (20 Marks)

Module-3

- 5 a. Define the following terms with respect to working of governors :
i) Sensitiveness ii) Isochronism iii) Stability iv) Controlling force. (08 Marks)
b. In a Hartnell governor, the extreme radii of rotation of the balls are 40mm and 60mm and corresponding speeds are 210 rpm and 230rpm. The mass of each ball is 3kg. The ball and sleeve arms are equal. Determine i) Spring loads at minimum and maximum speeds.
ii) Stiffness of the spring iii) Initial compression of the spring. (12 Marks)

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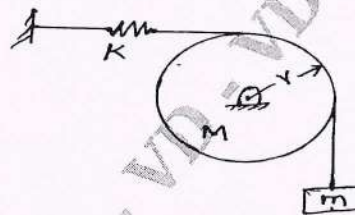
OR

- 6 a. Derive an expression for Gyroscopic Couple $C = I W \omega_p$ with usual notations. (08 Marks)
- b. Each wheel of a motorcycle is of 600mm diameter and has a moment of inertia of $1.2 \text{ kg} - \text{m}^2$. The total mass of the motorcycle and the rider is 180kg and combined centre of mass is 580mm above the ground level when motor cycle is upright. The moment of inertia of the rotating parts of engine is $0.2 \text{ kg} - \text{m}^2$. The engine speed is 5 times the speed of the wheels and is in the same sense. When the motorcycle takes a turn of 35m radius at a speed of 54km/h, determine the Gyroscopic couple, Centrifugal couple and Balancing couple in terms of angle of heel θ . Hence determine angle of heel necessary. (12 Marks)

Module-4

- 7 a. Derive the equation for natural frequency of the spring mass system considering the mass of the spring into account. (10 Marks)
- b. Find the natural frequency of the system shown in Fig. Q7(b), using Newton's method. (10 Marks)

Fig. Q7(b)



OR

- 8 a. Define the following with respect to vibration : i) Natural frequency ii) Resonance iii) Damping factor iv) Logarithmic decrement. (08 Marks)
- b. A vibrating system consists of a mass of 50kg, a spring with a stiffness of 30kN/m and a damper. The damping provided is only 20% of the critical value. Determine
 i) Damping factor ii) Critical damping coefficient
 iii) Natural frequency of damped vibration iv) Logarithmic decrement
 v) Ratio of two consecutive amplitudes. (12 Marks)

Module-5

- 9 a. Derive an expression for magnification factor for a spring mass system with viscous damping subjected to harmonic force. (10 Marks)
- b. A machine of mass 1000kg is acted upon by an external force 2450N at a frequency of 1500rpm. To reduce the effects of vibration, isolator of rubber having a static deflection of 2mm under the machine load and an estimated damping factor of 0.2 are used. Determine
 i) Amplitude of vibration ii) Force transmitted to the foundation. (10 Marks)

OR

- 10 a. The support of a spring mass system is vibrating with an amplitude of 8mm and a frequency of 1100 cycles/min. If the mass is 0.8kg and the spring has a stiffness of 2000N/m, determine the amplitude of vibration of the mass. What is the amplitude of a damper with damping factor of 0.2 is introduced in the system? (10 Marks)
- b. A rotor has a mass of 12kg and is mounted midway on a 24mm diameter horizontal shaft supported simply at the ends by two bearings. The bearings are 1m apart. The shaft rotates at 2400 rpm. If the centre of mass of the rotor is 0.11mm away from the geometric centre of the rotor due to manufacturing defect, find
 i) the amplitude of the steady state vibration
 ii) the dynamic force transmitted to the bearing. Take $E = 200 \text{ GPa}$. (10 Marks)

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18ME54

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021

Turbo Machines

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Draw and explain the part of a general Turbo machine. (06 Marks)
- b. Distinguish between Turbo machines with positive displacement machines. (06 Marks)
- c. A turbine model of 1:10 develops 2kW under a head of 6m at 500rpm. Find the power developed by the prototype under a head of 40m. Also find the speed of the prototype and its specific speed. Assume the turbine efficiencies to remain same. (08 Marks)

OR

- 2 a. Define the static and stagnation state of fluid. (04 Marks)
- b. Define the following with the help of h-s diagram for power absorbing and power generating machine :

- i) Total to total efficiency
- ii) Total to static efficiency
- iii) Static to total efficiency
- iv) Static to static efficiency

(08 Marks)

- c. Show that the polytropic efficiency during expansion process is given by

$$\eta_p = \frac{\ln(T_2 / T_1)}{\frac{\gamma - 1}{\gamma} \ln(P_1 / P_2)}$$

(08 Marks)

Module-2

- 3 a. Define Utilization factor and degree of reaction. Also derive the relation between utilization factor and degree of reaction. (10 Marks)
- b. Show that for maximum utilization of axial flow turbine with reaction = $\frac{1}{4}$. The speed ratio given by $\frac{U}{V_1} = \frac{2}{3} \cos \alpha_1$. Where U = Blade speed, V_1 = Inlet absolute velocity α_1 = Inlet Nozzle angle. (10 Marks)

OR

- 4 a. With necessary velocity triangles and assumption derive the expression for effect of blade discharge angle on energy transfer and degree of reaction for radial flow machines. (10 Marks)
- b. At a stage in a 50% Reaction axial flow machine running at 3000rpm, the blade mean diameter is 685mm. If the maximum utilization for the stage is 0.915. Calculate the absolute velocity at inlet and outlet and draw velocity triangles. Also find power output for flow rate of 15 Kg/s. (10 Marks)

Module-3

- 5 a. What is compounding of steam turbine? Explain method of compounding Impulse turbine. (10 Marks)
- b. The velocity of steam outflow from a Nozzle in a De-Laval turbine is 1200m/s, nozzle angle is 22°. The rotor blades are equiangular and rotational blade speed is 400m/s. Calculate:
 - i) Blade angles
 - ii) Tangential force
 - iii) Power product if $vr_1 = vr_2$
 - iv) blading efficiency.
 (10 Marks)

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2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

- 6 a. Derive the maximum blade efficiency equation for velocity compounded impulse steam Turbine (Curtis turbine) (10 Marks)
- b. In a Curtis steam turbine stage there are 2 row of moving blades with equiangular rotors. The steam enters 1st rotor with 29° each while second rotor with 32° each. The absolute velocity of steam enter the first rotor at 530 m/s. The friction factor is 0.9 in 1st rotor, 0.91 in stator and 0.93 in 2nd rotor. If final discharge is axial.
Find i) Mean blade speed ii) Power if $m_s = 3.2$ kg/s. (10 Marks)

Module-4

- 7 a. Derive an expression for work done by pelton wheel with necessary velocity triangles. (08 Marks)
- b. A Pelton wheel is to be designed for the following specifications :
Shaft power = 11772kW, Head = 380m, Speed = 750rpm, Overall efficiency = 86%, jet diameter not to exceed 1/6 of wheel diameter, Determine :
i) Wheel diameter ii) jet diameter iii) Number of jets required, Take $C_v = 0.98$, $\phi = 0.46$. (06 Marks)
- c. A Kaplan turbine develops 24647.6kW power at an average head of 39m. Assuming a speed ratio of 2, flow ratio 0.6, diameter of boss equal to 0.35 times diameter of runner and an overall efficiency of 90%, calculate the diameter, speed and specific speed of turbine. (06 Marks)

OR

- 8 a. Explain the working of Francis turbine with help of sectional arrangement diagram. Also draw the velocity triangles of Francis turbine. (12 Marks)
- b. Explain the function of draft tubes. (02 Marks)
- c. With neat sketches, explain the applications of draft tubes. (06 Marks)

Module-5

- 9 a. Derive an expression for the minimum speed of starting a centrifugal pump. (06 Marks)
- b. Derive the expression for pressure rise in the centrifugal pump. (08 Marks)
- c. The impeller of a centrifugal pump has outer diameter 1.2m is used to lift water at a rate of 1800kg/s. The blade is making an angle of 150° with the direction of motion at outlet and speed is being 2000rpm. If the radial velocity flow is 2.5m/s. Find impeller power. (06 Marks)

OR

- 10 a. Explain the working principle of centrifugal compressor with neat sketch. (10 Marks)
- b. A centrifugal compressor compresses 30kg of air per second at a rotational speed of 15000rpm. The air enter the compressor axially and the conditions at exit sections are :
radius = 0.3m, relative velocity of air at the tip is 100m/s at an exit angle of 80°. Find the torque and power required to drive the compressor and also the ideal head developed.
Take $P_{01} = 1$ bar and $T_{01} = 300$ K. (10 Marks)

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18ME55

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021 Fluid Power Engineering

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. State Pascal's law. Explain with a sketch its application to simple hydraulic jack. (10 Marks)
b. Sketch and explain the structure of hydraulic control system. (10 Marks)

OR

- 2 a. With the aid of neat sketches explain the following :
i) Suction line filtering
ii) Pressure line filtering
iii) Returns line filtering. (10 Marks)
b. Explain briefly the desirable properties of hydraulic fluid. (10 Marks)

Module-2

- 3 a. Sketch and explain the construction and working of 'External Gear Pump' giving expressions for volumetric displacement and theoretical flow rate. (10 Marks)
b. A vane pump has volumetric displacement of 82cm^3 . The diameter of rotor is 50mm and that of cam ring is 75mm. If the width of the vane rotor is 40mm. Find eccentricity, maximum eccentricity and maximum volumetric displacement possible. (10 Marks)

OR

- 4 a. Explain with a neat sketch of working of linear actuator with cushioning. (10 Marks)
b. An 8cm diameter hydraulic cylinder has 4cm diameter rod. If the cylinder receives flow at 100 lpm and 12 MPa. Find :
i) Maximum extension and retraction forces
ii) Maximum extension and retraction velocities. (10 Marks)

Module-3

- 5 a. Explain the internal construction and working of 4/2 spool valve. Draw its symbolic representation. (10 Marks)
b. With a neat sketch, explain pilot operated check valve. (10 Marks)

OR

- 6 a. Explain the meter-in method of speed control of hydraulic cylinder with neat circuit diagram. (10 Marks)
b. With a neat circuit diagram explain regenerative circuit used in drilling machine application. (10 Marks)

Module-4

- 7 a. Sketch and explain the structure of pneumatic control system. (10 Marks)
b. List the advantages and limitations of pneumatic power systems. (10 Marks)

1 of 2

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OR

- 8 a. What is FRL unit in pneumatic system? Explain its function with symbolic representation. (10 Marks)
b. Explain with a pneumatic circuit how quick exhaust valve can be used to increase the actuation speed of a cylinder. (10 Marks)

Module-5

- 9 a. Explain direct control of double acting cylinder using 5 ports/2 position DC valve. (10 Marks)
b. Explain 'supply air throttling' and 'exhaust air throttling' used in speed control of cylinders. (10 Marks)

OR

- 10 a. Explain a typical pneumatic circuit based on 'AND' logic function using two pressure valve. (10 Marks)
b. Explain the working of a solenoid controlled pilot operated DCV. (10 Marks)

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18ME56

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021 Operations Management

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Define operations management and explain briefly how the production systems are classified. (10 Marks)
- b. Explain briefly with a schematic model the functions within business organization and operation management. (10 Marks)

OR

- 2 a. What is decision making? Briefly explain the characteristics of operations decisions. (10 Marks)
- b. Explain Break even analysis with necessary equations, graph and assumptions (10 Marks)

Module-2

- 3 a. Define forecasting and explain briefly the steps involved in forecasting process. (10 Marks)
- b. Briefly explain the components of time series method with sketches. (10 Marks)

OR

- 4 a. Explain the following forecasting methods:
 - (i) Exponential smoothing. (10 Marks)
 - (ii) Linear regression. (10 Marks)
- b. A company adopts method of least squares to develop a linear trend equation for the data as shown in the table below:

Year (x)	1	2	3	4	5	6	7	8	9	10	11
Shipment in tones (y)	2	3	6	10	8	7	12	14	14	18	19

Calculate the trend forecast for the year 12 and 20. (10 Marks)

Module-3

- 5 a. Define the following :
 - (i) Design capacity (10 Marks)
 - (ii) System capacity (10 Marks)
 - (iii) Capacity planning
 - (iv) Facility layout. (10 Marks)
- b. Sketch and explain any two types of layouts. (10 Marks)

OR

- 6 a. What factors determines the types of layout used in an organization? (05 Marks)
- b. What are the determinants of effective capacity and briefly explain any two of them? (05 Marks)
- c. A metals processing firms wishes to install enough automatic moulders to produce 2,50,000 good castings per year. The moulding operation takes 1.5 minutes per casting, but its output is typically about 3% defective. How many moulders will required if each one is available for 2000 hours (of capacity) per year? (10 Marks)

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Module-4

- 7 a. Define Aggregate planning and master scheduling. Explain the pure strategies used for aggregate planning in brief. (10 Marks)
- b. A firm has developed the following demand forecast in units for a item which is influenced by seasonal factors. Suppose the firm estimates that it costs Rs 150/unit to increase production rate Rs 200/unit to decrease production rate Rs 50/unit/month to carry the inventory and Rs 100/unit subcontracted. Compare the costs incurred if the pure strategies are followed.

Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug
Forecast Demand	270	220	470	670	450	270	200	370

(10 Marks)

OR

- 8 a. Discuss the general techniques of aggregate planning process with flow chart. (08 Marks)
- b. State the functions of Master Scheduling. (04 Marks)
- c. What are the objectives and importance of Aggregate planning? (08 Marks)

Module-5

- 9 a. What is a Material Requirement Planning? What are the various steps involved in the implementation of MRP? (08 Marks)
- b. What are the benefits and limitations of MRP? (06 Marks)
- c. Define CRP and BOM. (06 Marks)

OR

- 10 a. What is Supply Chain Management? What are its functions? (08 Marks)
- b. Briefly explain Make or Buy decision. (06 Marks)
- c. Explain the different approaches to SCM. (06 Marks)

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17ME51

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021 Management and Engineering Economics

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Explain various functions of Management. (10 Marks)
b. Define Planning. Discuss steps commonly used in planning. (10 Marks)

OR

- 2 a. Explain principles of Management as formulated by Fayol. (10 Marks)
b. Explain the various steps in a decision making process, with a block diagram. (10 Marks)

Module-2

- 3 a. Explain the staff selection process in an organization listing the steps involved in the selection. (10 Marks)
b. Define Leadership. List the basic styles of leadership, briefly explaining each of them. (10 Marks)

OR

- 4 a. Define Controlling. Explain the steps involved in controlling. (10 Marks)
b. What is Span of Control? Explain the factors governing it. (10 Marks)

Module-3

- 5 a. Differentiate between Micro and Macro economics. (04 Marks)
b. Explain briefly with sketch : i) Law of demand ii) Law of supply. (06 Marks)
c. A working woman is planning for her retired life. She has 20 more years of service. She would like to deposit 10% of her salary which is Rs 5000 at the end of the first year and thereafter she wishes to deposit the same amount (Rs 5000) with the annual increase of Rs 1000 for the next 19 years with an interest rate of 18%. Find the total amount at the end of 20 years of service. (10 Marks)

OR

- 6 a. Explain the problem solving process in decision making with suitable examples. (06 Marks)
b. Explain Elasticity of demand, with an example. (04 Marks)
c. Find the effective rate of interest if the nominal annual rate of interest is 8%, when compounded : i) Yearly ii) Biannually iii) Quarterly iv) Monthly v) Daily. Compare the results. (10 Marks)

Module-4

- 7 a. Explain with suitable example : i) Present worth comparison method ii) Future worth comparison method iii) Annual worth equivalent method. (10 Marks)
b. Compare the alternative below using present worth analysis at $i = 10\%$.

Particulars	Machine A	Machine B
First cost	Rs 20000	Rs 30000
Annual cost	Rs 9000	Rs 7000
Salvage value	Nil	Nil
Life	3 years	6 years

(10 Marks)

OR

- 8 a. Explain IRR, ERR and MARR. Enlist the misconcepts of ERR. (08 Marks)
 b. A certain individual firm derives and economic analysis to determine which of the two machines is attractive in a given interval of time. The minimum attractive rate of return is 15%. Following data to be used for analysis.

Particulars	Machine X	Machine Y
First cost	Rs 150000	Rs 240000
Estimated life	12 years	12 years
Salvage value	0	6000
Annual maintenance cost	0	Rs 4500

Which machine you would choose? Base your answer on annual equivalent cost. (12 Marks)

Module-5

- 9 a. Explain the following terms : i) Prime cost ii) Factory cost iii) Office cost
 iv) Total cost v) Selling price. (10 Marks)
 b. A manufacturing firm is producing 1000 pens/day. The cost of direct material is Rs 1600/- and that of direct labour is Rs 2000/-. Factory overheads chargeable to it are Rs 2500. If the selling on cost is 40% of factory cost, what must be the selling price of each pen to realize a profit of 20% on each pen sold? (10 Marks)

OR

- 10 a. What is Depreciation? List different methods of determining depreciation. Explain any two of them. (10 Marks)
 b. A Company purchases a lathe machine for Rs 500000 for operating it for 5 years at an interest rate of 5%. If the salvage value is Rs 60000 after 5 years, determine
 i) Sinking fund amount ii) Annual depreciation cost. (10 Marks)

CBCS SCHEME

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17ME53

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021 Turbomachines

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Define specific speed of turbine and hence derive an expression for specific speed of turbine. (06 Marks)
- b. A Pelton wheel is running at a speed of 200rpm and develops 5200KW when working under a head of 220m with an overall efficiency of 80%. Determine its unit speed, unit flow, unit power and specific speed. Find the speed, flow and power when its operating condition changes to a head of 140m. (08 Marks)
- c. A full scale centrifugal pump running at 500rpm delivers $5\text{m}^3/\text{s}$ against a head of 100m. A model of the pump delivers $0.3\text{m}^3/\text{s}$ with a power input of 100KW at an efficiency of 90%. Calculate the speed of the model and scale ratio. (06 Marks)

OR

- 2 a. Applying First law of thermodynamics to turbomachines, prove that the work transfer is numerically equal to the change in total enthalpy between inlet and outlet of the machine. (06 Marks)
- b. With the help of h-s diagram define the following with respect to turbines :
 - i) Total-to-total efficiency
 - ii) Total-to-static efficiency. (06 Marks)
- c. Liquid water flows through pump from an elevation of 1m at the inlet to an elevation of 2m at the exit from the centre of the pump respectively. The static pressure increases from 10cm to 150cm of mercury between the inlet and exit. The inlet and exit velocities are 5m/s and 10m/s respectively. Evaluate the isentropic enthalpy increase across the pump. Also find the power required to drive the pump and the actual change in enthalpy if the total - to - total isentropic efficiency of the pump is 75%. The mass flow rate of water in pump is 100kg/min. (08 Marks)

Module-2

- 3 a. Define degree of reaction and utilization factor. Obtain the general equation for utilization factor in terms of degree of reaction, absolute velocities at inlet and outlet of the turbine. (08 Marks)
- b. At a stage of an impulse turbine, the mean blade diameter is 0.75m, its rotational speed being 3500rpm. The absolute velocity of fluid exiting from a nozzle inclined at 20° to the wheel tangent is 275m/s. If the utilization factor is 0.9 and the relative velocity at rotor exit is 0.9 times that at inlet, find the inlet and exit rotor angles. Also find the power output from the stage for a mass flow rate of 2 kg/s and axial thrust on the shaft. (12 Marks)

OR

- 4 a. Prove that the degree of reaction for an axial flow compressor is given by

$$R = \frac{V_a}{2U} \left[\frac{\tan \beta_2 + \tan \beta_1}{\tan \beta_1 + \tan \beta_2} \right]$$

Where V_a = Axial component of flow velocity, U = tangential velocity of rotor, β_1 and β_2 are the rotor angles at inlet and exit measured with reference to tangential direction.

(10 Marks)

- b. A single stage axial flow blower with no inlet guide vanes, operates at 3600rpm. The tip and hub diameters of the rotor are 20cm and 12.5cm respectively. The air flow through the stage is 0.45kg/s. The air turned through an angle of 20° towards the axial direction during the passage through the rotor at the mean diameter. Assuming the inlet conditions of pressure of 1 bar and 25°C , constant axial velocity and no losses in the rotor, compute :
- i) The power input in KW ii) degree of reaction. (10 Marks)

Module-3

- 5 a. Derive the condition for maximum blade efficiency with equip-angular blades in an impulse steam turbine. (08 Marks)
- b. In a Curtis stage with two rows of moving blades, the rotors 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 of nozzle is 530m/s and blade coefficients are 0.9 in the first moving row, 0.95 in the stator and in the second moving row. If the absolute velocity at the stage exit should be axial, find :
- i) Mean blade speed
ii) The rotor efficiency
iii) The power output for a steam flow rate of 1kg/s. (12 Marks)

OR

- 6 a. Prove that the maximum blade efficiency in a Parason's reaction steam turbine is given by :

$$\eta_{b,\max} = \frac{2 \cos^2 \alpha_1}{1 + \cos^2 \alpha_1} \quad (08 \text{ Marks})$$

- b. At a stage of a turbine with Parason's blading deliver dry saturated steam at 2.7 bar from fixed blades at 90m/s. The mean blade height is 40mm, and the moving blade exit angle is 20° . The axial velocity of steam is $\frac{3}{4}$ times the blade velocity at the mean radius. Steam is supplied to the stage at the rate of 9000kg/h. The effect of blade tip thickness on the annulus area can be neglected calculate : i) the wheel speed in RPM ii) the diagram efficiency iii) the diagram power iv) the enthalpy drop of the steam in this stage. (12 Marks)

Module-4

- 7 a. With the necessary velocity triangles, show that the maximum hydraulic efficiency of a Pelton wheel is given by $\eta_{H,\max} = \frac{1 + c_b \cos \beta_2}{2}$, where $c_b = V_{r2}/V_{r1}$ and β_2 is bucket tip angle. (08 Marks)
- b. A double jet Pelton wheel is required to generate 7500KW 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) The diameter of each jet ii) total flow iii) force exerted by the jets in the tangential direction. Assume generator efficiency is 95%, overall efficiency is 80% and speed ratio = 0.47. (12 Marks)

OR

- 8 a. For Francis turbine, show that the hydraulic efficiency = $\frac{2}{2 + \tan^2 \alpha_1}$ for the following conditions : i) the component of velocity normal to the tangential direction is constant from inlet to outlet ii) relative velocity at the inlet is radial iii) absolute velocity at the outlet is radial. Where α_1 = flow angle at inlet. Sketch the velocity triangles at inlet and outlet. (08 Marks)
- b. An inward flow reaction turbine has a runner 0.5m diameter and 7.5cm wide. The inner diameter is 0.35m. The effective area of flow is 93% of the gross area and the flow velocity is constant. The guide vane angle is 23° inlet moving vane angle is 97° and the outlet vane angle is 30°. Assuming radial discharge at the exit, calculate the speed of the wheel so that the water enters without shock and the supply head of 60m. Assume hydraulic friction losses of 10% and mechanical efficiency as 94%. What is the specific speed of the machine? (12 Marks)

Module 5

- 9 a. Show that the pressure rise in the impeller of a centrifugal pump, when the frictional and other losses in the impeller are neglected, is given by $\frac{1}{2g} [V_{f1}^2 + u_2^2 - V_{f2}^2 \text{cosec}^2 \beta_2]$. Where V_{f1} and V_{f2} are the flow velocities at inlet and outlet of the impeller, u_2 = tangential velocity of the impeller at exit and β_2 = exit blade angle. (08 Marks)
- b. Derive an expression for minimum speed of CF pump to start the flow. (04 Marks)
- c. Find the power required to drive the CF pump which delivers 0.04m³/p of water at a height of 20m through a 15cm diameter of pipe and 100m long. The overall efficiency of the pump is 70% and the friction factor is assumed to be 0.015. (08 Marks)

OR

- 10 a. Explain the phenomena of :
Surging
Stalling and
Choking in a centrifugal compressor stage. (06 Marks)
- b. Show that the H-Q characteristic equation for centrifugal blower is given by $H = K_1 - K_2 Q$
Where $K_1 = \frac{u_2^2}{g}$, $K_2 = \frac{u_2 \cot \beta_2}{g \cdot \pi D_2 \cdot b_2}$. (06 Marks)
- c. An axial flow compressor of 50% reaction design has blades with inlet and outlet angle with reference to axial direction of 45° and 10° respectively. The compressor is to produce a pressure ratio of 6 : 1 with an isentropic efficiency of 0.85 when inlet static temperature is 37°C. The blade speed and axial velocity are constant throughout the compressor. Assuming a blade speed of 200m/s, find the number of stages required if the work done factor is i) unity ii) 0.87 for all stages. (08 Marks)

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17ME54

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

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Define standards and codes. (04 Marks)
b. A circular rod of diameter 60 mm is subjected to bending load and torsional load as shown in Fig. Q1 (b). Determine the nature and magnitude of stresses at the critical points. (16 Marks)

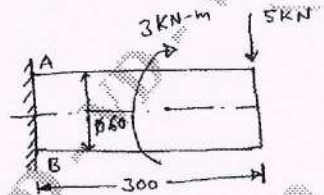


Fig. Q1 (b)

OR

- 2 a. Define stress concentration and stress concentration factor. (04 Marks)
b. Determine the safe load that can be carried by a bar of rectangular cross section as shown in Fig. Q2 (b) limiting the maximum stress to 130 MPa taking stress concentration into account. (16 Marks)

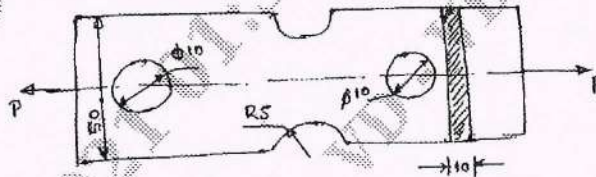


Fig. Q2 (b)

Module-2

- 3 a. Derive an equation for impact stress due to axial load. (08 Marks)
b. A weight of 1 kN is dropped from a height of 50 mm at the free end of a Cantilever beam of effective length 300 mm. Determine the cross section of the Cantilever beam of square cross section. If the allowable stress in material of beam is limited to 80 MPa. ($E = 206.8 \cdot 10^3 \text{ N/mm}^2$). (12 Marks)

OR

- 4 a. Derive an equation for Goodman criterion. (08 Marks)
b. A piston rod is subjected to a maximum reversed axial load of 110 kN. It is made of steel having an ultimate stress of 90 N/mm² and the surface is machined. The average endurance limit is 50% of ultimate strength. Take the size correction coefficient as 0.85 and factor of safety = 1.75. Determine the diameter of the rod. (12 Marks)

Module-3

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

OR

- 6 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% higher 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. (20 Marks)

Module-4

- 7 a. A double riveted lap joint is to be made between 9 mm plates. If the safe working stresses in tension, crushing and shear are 80 N/mm^2 , 120 N/mm^2 and 60 N/mm^2 respectively, design the riveted joint. (10 Marks)
- b. Find the diameter of the rivet as shown in Fig. Q7(b). The maximum shearing stress on the most heavily loaded rivet is 56 N/mm^2 . (10 Marks)

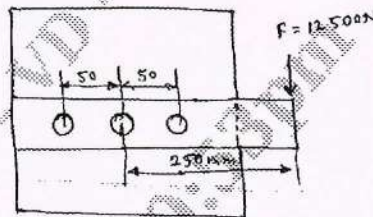


Fig. Q7 (b)

OR

- 8 a. A welded connection of steel plates shown in Fig. Q8 (a) subjected to eccentric load 10 kN. Determine size of weld. If permissible stress limited to 95 N/mm^2 . Assume static conditions. (10 Marks)

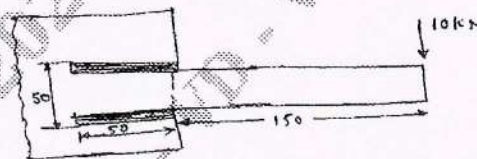


Fig. Q8 (a)

- b. Determine the allowable stress in the joint as shown in Fig. Q8 (b), if the size of weld 10 mm. (10 Marks)

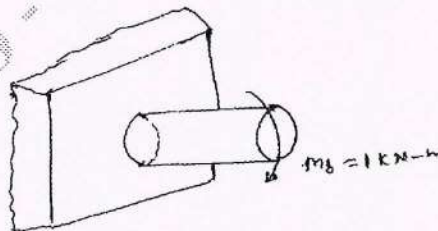


Fig. Q8 (b)

Module-5

- 9 a. A pulley bracket is as shown in Fig. Q9 (a) supported by 4 bolts, two at A – A and two at B – B. Determine the size of bolts using an allowable shear stress of 25 N/mm^2 for the material of the bolts. (10 Marks)

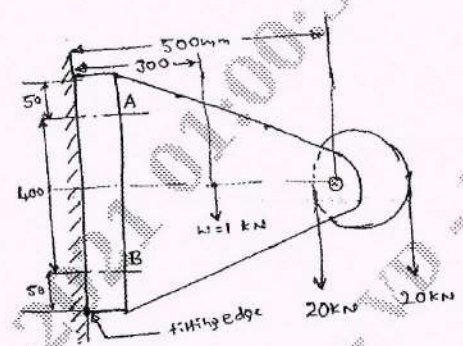


Fig. Q9 (a)

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

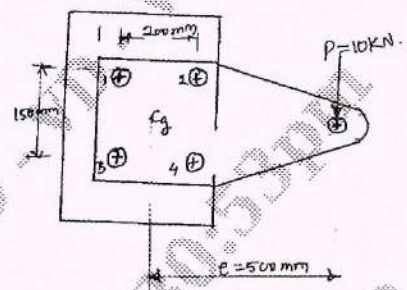


Fig. Q9 (b)

OR

- 10 a. A power screw for a jack has square threads of proportion $50 \times 42 \times 8$. The coefficient of friction at threads 0.1 and collar 0.12. Determine the weight lifted is jack with human effort of 400 N; through hand lever of span 400 mm. (10 Marks)
- b. A single threaded power screw has a major diameter restriction of 36 mm. Design the screw if the frictional coefficient for thread and collar 0.13 and 0.1 respectively. Estimate the power input to rotate screw at 1 rpm, if the load lifted is 5 kN. (10 Marks)

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17ME554

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021 Non-Traditional Machining

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. List and explain the various factors to be considered for selection of machining process. (10 Marks)
- b. Distinguish between conventional and unconventional manufacturing process. (10 Marks)

OR

- 2 a. Explain how the non-traditional machining processes are classified. (10 Marks)
- b. Justify the need of unconventional manufacturing process in today's industries with suitable examples. (10 Marks)

Module-2

- 3 a. Sketch and explain the working principle of ultrasonic machining process. (10 Marks)
- b. Explain with neat sketch various tool feed mechanisms used in ultrasonic machining process. (10 Marks)

OR

- 4 a. Explain in details the process parameters that effect the performance of abrasive jet machining process. (10 Marks)
- b. With neat sketch, explain the working of water jet machining process. (10 Marks)

Module-3

- 5 a. Explain the process parameters of electro-chemical machining process. (10 Marks)
- b. With neat sketch, explain the working principle of electro chemical machining. Also list the advantages and disadvantages of electrochemical machining. (10 Marks)

OR

- 6 a. Explain with neat block diagram, process steps for chemical milling. (10 Marks)
- b. Explain with block diagram steps involved in chemical blanking. (10 Marks)

Module-4

- 7 a. Explain with neat sketch plasma arc machining process. (10 Marks)
- b. What are the factors that govern the performance of plasma arc machining? Explain in detail any two factors. (10 Marks)

OR

- 8 a. Explain with the help of neat sketches, the mechanism of metal removal in EDM process and mention its advantages and disadvantages. (10 Marks)
- b. Explain with sketch the electrode feed control in electric discharge machining process. Also, explain any two methods of flushing used in EDM. (10 Marks)

Module-5

- 9 a. With neat sketch, explain laser beam machining process. (10 Marks)
- b. Discuss various process parameters of LBM process. Also, list the advantages and disadvantages of LBM. (10 Marks)

OR

- 10 a. Explain with neat sketch the working principle of electron beam machining process. (10 Marks)
- b. Describe the apparatus used to generate the laser. (05 Marks)
- c. Discuss the parameters influencing MRR in EBM. (05 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.

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17ME564

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021 Project Management

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Define project and project management? (04 Marks)
- b. Define and Explain project life cycle with the help of schematic flow diagram showing the stages. (08 Marks)
- c. Write a note on project roles. (08 Marks)

OR

- 2 a. Explain strategic planning and portfolio alignment considering suitable Example. (10 Marks)
- b. List and Explain the methods available for selecting projects (10 Marks)

Module-2

- 3 a. Brief the steps involved in defining the project scope. (06 Marks)
- b. What is the WBS? Explain any three formats of WBS. (10 Marks)
- c. Explain the WBS construction steps in brief. (04 Marks)

OR

- 4 a. What are the purposes of a project schedule? (03 Marks)
- b. Write a note on historical development of project schedules. (07 Marks)
- c. Explain the two pass method used to develop project schedules. (10 Marks)

Module-3

- 5 a. Describe the abilities needed for project manager while resourcing projects. (06 Marks)
- b. Describe the importance of activity resource Estimating. (06 Marks)
- c. Describe the potential timing issues can occur early in a project and at the end of a project. (08 Marks)

OR

- 6 a. What is risk management planning? Explain any three different categories of project success measures. (07 Marks)
- b. Select any two project quality tools for each phase of the project and write their uses. (13 Marks)

Module-4

- 7 a. Introduce project supply chain management and explain its components in brief. (14 Marks)
- b. Explain project balanced score card approach. (06 Marks)

OR

- 8 a. Describe the purpose of using an integrated change control system. (09 Marks)
- b. Write a note on early termination of projects. (05 Marks)
- c. Write a note on post-project activities. (06 Marks)

Module-5

- 9 a. Explain the Errors which would likely to occur during drawing of network diagrams. (06 Marks)
- b. Describe network construction rules. (08 Marks)
- c. Write a short note on AOA and AON diagrams. (06 Marks)

1 of 2

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.

OR

10 a. A Project consists of the following activities with their precedence relationship and duration in days.

- Draw the network of the project.
- Identify the critical path and the project duration.
- Calculate EST, EFT, LST, LFT, TF, FF and IF for each activity.

(14 Marks)

Activity	Precedence	Duration (in days)
A	-	10
B	A	8
C	A	7
D	B	9
E	B	6
F	B,C	10
G	B,C	04
H	D,F	12

b. Differentiates between PERT and CPM.

(06 Marks)

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15
15ME51

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021 Management and Engineering Economics

Time: 3 hrs.

Max. Marks: 80

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

Module-1

- 1 a. Define Management. Differentiate between Administration and Management. (08 Marks)
b. Explain briefly the purpose and planning. (08 Marks)

OR

- 2 a. Briefly explain, whether management is a Science (or) Art. (08 Marks)
b. Explain briefly the main steps involved in planning. (08 Marks)

Module-2

- 3 a. Explain with a neat diagram, line and staff organization. (08 Marks)
b. Briefly explain the techniques of selection. (08 Marks)

OR

- 4 a. Describe briefly the essentials of a Sound Control System. (08 Marks)
b. Briefly explain the Maslow's Hierarchy of needs. (08 Marks)

Module-3

- 5 a. Explain how Cash Flow Diagrams (CFD) are helpful to the decision maker to understand and solve Engineering Economics problems and give borrower's and lender's perspectives for cash flow diagram. (08 Marks)
b. A person is planning for his retired life. He has 10 more years of service. He would like to deposit 20% of his salary which is Rs 10,000/- at the end of the First year and there after he wishes to deposit the same amount (Rs 10,000) with an Annual increase of Rs 2000/- for the next 9 years with an interest rate of 20%. Find the total amount at the end of the 10th year of the above series. (08 Marks)

OR

- 6 a. State and explain Law of Returns. (08 Marks)
b. Determine the effective interest rate in the following cases :
i) Nominal rate of 12% compounded monthly with time interval of one year.
ii) Nominal rate of 18% compounded weekly with a time interval of one year.
iii) Nominal rate of 13% compounded monthly with a time interval of two years.
iv) Nominal rate of 9% compounded semi annually with a time interval of two years. (08 Marks)

Module-4

- 7 a. Two motorcycles of brand "A" and "B" are available on the following terms :
i) Motor cycle "A" – make a down payment of Rs 5,000/- and then Rs 6,000/- at the end of each year for 7 years.
ii) Motor cycle "B" – make a down payment of Rs 15,000/- and no payment for the next 3 years. From end of the 4th year annual payments of Rs 12,000/- for the next 3 years. Find the future worth of Motor cycle A & B. (08 Marks)

1 of 2

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.

- b. A stand by lighting generator is required for a shop. Two types are available. If both generators have a life of 4 years and the interest rate is 15% per year, which offers the lowest equivalent annual cost.

	Type - 1	Type - 2
First - Cost	Rs 5,000/-	Rs 3,200/-
Salvage value	Rs 1,000/-	- Nil -
Annual operating costs	Rs 780/-	Rs 950/-

(08 Marks)

OR

- 8 a. Compare the two investment proposals given below, if the firms MARR is 15%. Life of all the two proposals is 10 years. Compare using IRR.

Investment proposal	Initial Cost	Annual Return
Proposal 1	5,50,000/-	1,40,000/-
Proposal 2	6,25,000/-	1,60,000/-

(08 Marks)

- b. A crane can be taken on lease for a project for 3 years for Rs 1,80,000/- payable now, maintenance included. It can also be purchased for Rs 2,40,000/- and be sold at the end of 3 years for Rs 1,00,000/-. Maintenance costs are expected to be Rs 5,000/- per year for the first two years and Rs 10,000/- for the third year payable at the end of each year. At what interest rates would the two alternatives be equivalent?

(08 Marks)

Module-5

- 9 a. Briefly explain the functions of Estimating department. (08 Marks)
- b. A CNC machine costs Rs 30,00,000/- is estimated to serve for 8 years after which its salvage value is estimated to be Rs 2,50,000/- Find
- Depreciation fund at the end of the 5th year by Fixed percentage method and Declining Balance method.
 - Book value of the machine after 4th year and 6th year by Declining Balance method.

(08 Marks)

OR

- 10 a. Explain with a block diagram the elements of cost and components of cost. (08 Marks)
- b. 'Pizza corner' employed 75 workers in a particular month to work in the outlets as well as for home delivery. The following are the details of expenditure :
- Cost of material = Rs 80,000/-
 - Rate of wages for each workers = Rs 20 per hour of normal duty, Rs 40 per hour of overtime duty.
 - Man hours per day of normal duty = 8 hours.
 - Number of holidays per month (without wages) = 5 days.
 - Total overhead expenses = Rs 20,000/-.
 - Total overtime availed by workers = 200 hours.
 - Profit = 20% of total cost.
- Determine
- Total cost for the month.
 - Profit for the month.
 - Man hour rate of overheads.

(08 Marks)

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15ME52

Fifth Semester B.E. Degree Examination, Jan./Feb.2021 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 4 bar mechanism under the action of two external forces is shown in Fig. Q1. Determine the torque to be applied on the link AB for static equilibrium. The dimensions of the links are AB = 50 mm, BC = 66 mm, CD = 55 mm, CE = 25 mm, CF = 30 mm $\angle BAD = 60^\circ$ and AD = 100 mm, CF = 30 mm, CE = 25 mm. (16 Marks)

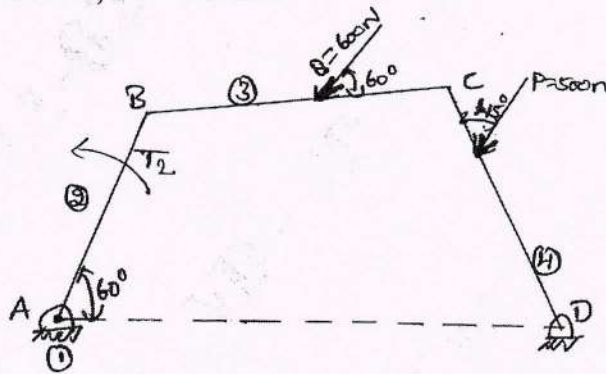


Fig. Q1

OR

- 2 The following data relate to a connecting rod of a reciprocating engine: Mass = 50 kg; Distance between bearing centres = 900 mm; Diameter of small end bearing = 70 mm; Diameter of big end bearing = 90 mm; Time of oscillation when the connecting rod is connected from small end is 1.9 seconds; Time of Oscillation when the connecting rod is connected from big end = 1.7 seconds. Determine (i) Radius of gyration of the rod is connected about an axis through centre of mass perpendicular to the plane of oscillation. (ii) Moment of Inertia of the rod about the same axis. (iii) Dynamically equivalent system of connecting rod comprising two masses one at small end bearing centre. (16 Marks)

Module-2

- 3 a. Explain static and dynamic balancing of rotating masses. (04 Marks)
 b. Four masses of magnitude 5, 6, M and 8 kg revolve in planes A, B, C and D respectively. The planes B, C, D are placed at a distance 0.3 m, 1.2 m and 2.0 m respectively from A. The masses are at same radii of 0.3 m. Find the magnitude of M and relative angular position of all masses for compute balance. (12 Marks)

OR

- 4 A four crank engine has two outer cranks set at 120° to each other and their reciprocating masses are each 400 kg. The distance between planes of rotation of adjacent cranks are 450 mm, 750 mm and 600 mm. 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 crank is 300 mm, length of connecting rod is 1.2 m and speed of rotation is 240 rpm. Find the maximum secondary unbalanced force. (16 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.

Module-3

- 5 a. Explain the following: (i) Isochronous governors (ii) Hunting (iii) Sensitiveness of governors. (06 Marks)
- b. In a spring controlled governor, the curve of controlling force is straight line. When balls are 400 mm apart, the controlling force is 1200 N and when 200 mm apart the controlling force is 450 N. At what speed will the governor run when the balls are 250 mm apart? What initial tension on the spring would be required for isochronisms and what would then be the speed? The mass of each ball is 9 kg. (10 Marks)

OR

- 6 a. Explain with neat sketch the Gyroscopic effect of an Aeroplane. (08 Marks)
- b. A four wheeled trolley car has a total mass of 3000 kg. Each axle with its two wheels and gears has a total MI of 32 kg m^2 . Each wheel is of 450 mm radius. The centre distance between two wheels is 1.4 m. Each Axle is driven by a motor with speed ratio of 1 : 3. Each motor along with its gear has a M.I. 16 kgm^2 and rotates in the opposite direction to that of axle. The center of mass of the car is 1 m above the rails. Calculate the limiting speed of the car when it has to travel around a curve of 250 m radius without leaving the rails. (08 Marks)

Module-4

- 7 a. Add the following two S.H.M and check it graphically,
 $x_1 = 4 \sin \left[wt + \frac{\pi}{3} \right]$, $x_2 = -6 \cos \left[wt + \frac{2\pi}{3} \right]$. (08 Marks)
- b. Determine the natural frequency of the simple pendulum, (i) Neglecting mass of rod (ii) Considering the mass of rod. (08 Marks)

OR

- 8 Determine the natural frequency of the system as shown in Fig. Q8 (a) and Fig. Q8 (b). (16 Marks)

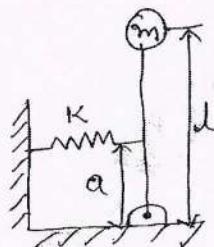


Fig. Q8 (a)

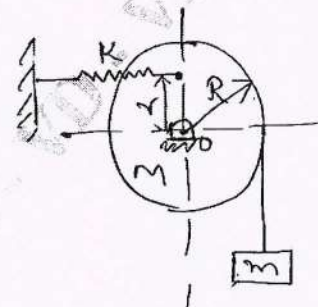


Fig. Q8 (b)

Module-5

- 9 a. Derive a governing differential equation of damped free vibration (viscous damping). (08 Marks)
- b. A mass of 7.5 kg hangs from a spring and makes damped oscillations. The time for 60 oscillations is 35 secs and the ratio of first to seventh displacement is found to be 2.5. Find (i) Stiffness of spring (ii) Damping resistance (iii) If the oscillations were critically damped what is the damping resistance. (08 Marks)

OR

- 10 a. Explain the transmissibility ratio and explain different cases with curve. (06 Marks)
- b. Determine the critical speed when an automobile trailer is traveling over a road with the road surface varies sinusoidally with a wave length of 15 meters and amplitude of 0.075 m. The springs of automobile are compressed 0.125 m under its own weight. Also determine the amplitude of vibration at 50 km/hr. (10 Marks)

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15ME53

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021 Turbo Machines

Time: 3 hrs.

Max. Marks: 80

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

Module-1

- 1 a. Distinguish between a Turbo Machine and a positive displacement machine. (06 Marks)
 b. Define the specific speed of a turbine. (02 Marks)
 c. A one-fifth scale model of a pump was tested in a laboratory at 1000rpm. The head developed and the power input at the best efficiency point were found to be 8m and 30kW respectively. If the prototype pump has to work against a head of 25m, determine its working speed, the power required to drive it and the ratio of the flow rates handled by the two pumps. (08 Marks)

OR

- 2 a. Define Mach number and explain with neat sketch: i) The subsonic flow ii) Sonic flow of a compressible fluid. (08 Marks)
 b. An air compressor has eight stages of equal pressure ratio 1.3. The flow rate through the compressor and its overall efficiency are 45kg/s and 80% respectively. If the conditions of air at entry are 1 bar and 35°C determine: i) State of air at compressor exit ii) Polytropic efficiency iii) Stage efficiency. (08 Marks)

Module-2

- 3 a. Derive head-capacity relationship for centrifugal pump and explain the effect of discharge angle on it. (08 Marks)
 b. At a 50% reaction stage axial flow turbine, the mean blade diameter is 60cm. The maximum utilization factor is 0.9, steam flow rate is 10kg/s. Calculate the inlet and outlet absolute velocities and power developed if the speed is 2000 rpm. (08 Marks)

OR

- 4 a. Show that ϵ_{max} of an axial flow turbine with degree of reaction = 1/4, the relationship of blades speed 'U' to absolute velocity at rotor inlet 'V₁' should be $\frac{U}{V_1} = \frac{2}{3} \cos \alpha$. Where 'α' is nozzle angle at inlet. (08 Marks)
 b. A single stage axial flow blower with no inlet guide vanes, operates at 3600RPM. The tip and hub diameters of the rotors are 20cm and 12.5cm respectively. The air flow through the stage is 0.45kg/s. The air turned through an angle of 20° towards the axial direction during the passage through the rotor at the mean diameter. Assuming standard atmospheric conditions, constant axial velocity and no losses in the rotor. Compare i) The power input in kW ii) Degree of reaction. (08 Marks)

Module-3

- 5 a. Define degree of reaction. Prove that moving blades and final blades should have the same shape for a 50% reaction. (08 Marks)
 b. Following data refers to a De Laval steam turbine having equiangular blades; Blade speed = 20m/s, Blade velocity co-efficient = 0.85, Mass flow rate of steam = 3kg/s, Absolute velocity of steam at exit from stage = 90m/s, Angle of absolute velocity of steam at exit from stage with tangent of wheel = 75°, Determine i) The blade angle ii) The nozzle angle iii) Absolute velocity of steam at inlet iv) Power developed. (08 Marks)

1 of 2

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.

OR

- 6 a. What is compounding of steam turbine? Explain pressure compounding of steam turbine with a neat sketch. (08 Marks)
- b. In a 50% reaction turbine, the blade tips are inclined at 35° and 20° in the direction of motion. At a certain place in the turbine, the drum diameter is 1 meter and the blades are 10cm high. At this place the steam having specific volume of $0.938\text{m}^3/\text{kg}$, passes through the blades without shock. Find the mass of steam flow and power developed of the speed of the turbine is 250rpm. (08 Marks)

Module-4

- 7 a. Explain the working of Francis turbine with a neat sketch. (08 Marks)
- b. Determine the power given by the jet of water to the runner of a pelton wheel which is having tangential velocity as 20m/s. The net head on the turbine is 50m and discharge through the jet water is $0.03\text{m}^3/\text{s}$. The side clearance angle is 15° and take $C_v = 0.975$. Find also the manometric efficiency. (08 Marks)

OR

- 8 a. Derive an expression for maximum efficiency of the pelton wheel giving the relationship between the jet speed and bucket speed. (08 Marks)
- b. The external and internal diameters of an inward flow reaction turbine are 1.2m and 0.6m respectively. The head on the turbine is 22m and velocity of flow through the runner is constant and equal to 2.5m/s. The guide blade angle is given as 10° and the runner vanes are radial at inlet. If the discharge at outlet is radial determine : i) The speed of the turbine ii) The vane angle at outlet of the runner iii) Hydraulic efficiency. (08 Marks)

Module-5

- 9 a. Derive an expression for the minimum speed for starting a centrifugal pump. (08 Marks)
- b. A three stage centrifugal pump has impellers 40cm in diameter and 2cm wide at outlet. The vanes area curved back at the outlet at 45° and reduce the circumferential area by 10%. The manometric efficiency is 90% and the overall efficiency is 80%. Determine the head generated by the pump when running at 1000rpm, delivering 50 litres per second. What should be the shaft power? (08 Marks)

OR

- 10 a. With neat sketch, explain slip, slip coefficient and slip factor. (06 Marks)
- b. Explain phenomenon of surging. (02 Marks)
- c. An axial flow compressor has the following data:
 Entry conditions : 1 bar and 20°C
 Degree of reaction : 50%
 Mean blade ring diameter : 36cm
 Rotational speed : 18000rpm
 Blade angle at rotor and stator exit : 65°
 Axial velocity : 180m/s
 Mechanical efficient : 96.7%
 Find: i) Blade angle at rotor and stator inlet ii) Power required. (08 Marks)

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CBCS SCHEME

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15ME54

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021

Design of Machine Elements - I

Time: 3 hrs.

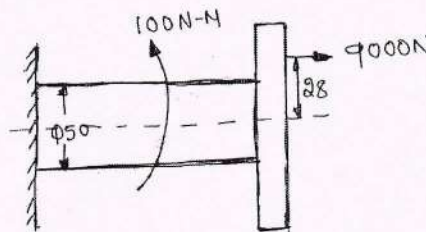
Max. Marks: 80

- Note : 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of Design Data Handbook is permitted.

Module-1

- 1 a. Briefly explain the phases of design process. (04 Marks)
b. Define Standards and Codes. (04 Marks)
c. A 50mm diameter steel rod supports a 9kN load in addition is subjected to a torsional moment of 100N-m as shown in Fig. Q1(c). Determine the maximum tensile and the maximum shear stress. (08 Marks)

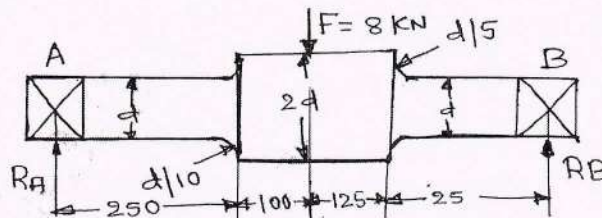
Fig. Q1(c)



OR

- 2 a. Define the Stress concentration and give three examples of how to reduce stress concentration. (06 Marks)
b. A stepped shaft shown in Fig. Q2(b) is subjected to a transverse load. The shaft is made of steel with ultimate tensile strength of 400MPa. Determine the diameter 'd' of the shaft based on the factor of safety of 2. (10 Marks)

Fig. Q2(b)



Module-2

- 3 a. Derive the equation for impact stress in Axial load. (06 Marks)
b. A machine element in the form of a cantilever beam has a rectangular cross section of 40mm width and 120mm depth. The span of the beam is 600mm. A transverse load of 5kN falls from a height of 'h' at the free end of the beam. Determine a safe value for 'h' limiting the maximum normal stress induced in the machine element, due to impact to 120MPa. The modulus of elasticity of the material of the beam is 210 GPa. (10 Marks)

OR

- 4 a. Derive the Soderberg equation for designing members subjected to fatigue loading.

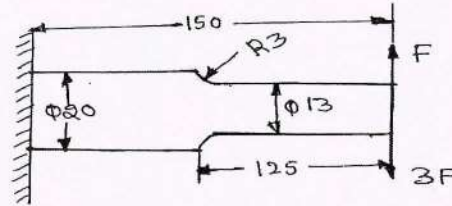
(06 Marks)

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.

- b. A cantilever beam made of cold drawn carbon steel ($\sigma_u = 550 \text{ MPa}$, $\sigma_y = 470 \text{ MPa}$, $\sigma_{-1} = 275 \text{ MPa}$) of circular cross – section is subjected to load which varies from $-F$ to $3F$. Determine the maximum load that this member can withstand for an infinite life as shown in Fig.Q4(b). Using a Factor of safety of 2. Taking $es\tau = 0.85$, $esr = 0.83$, $e\ell = 1$ and $q = 1$.

(10 Marks)

Fig. Q4(b)



Module-3

- 5 A machine shaft turning at 600rpm is supported on bearings 750mm apart. 15kW is supplied to the shaft through a 450mm pulley located 250mm to the right bearing. The power is transmitted from the shaft through a 200mm spur gear located 250mm to the right of the left bearing. The belt drive is at an angle of 60° above the horizontal. The pulley weights 800N to provide some fly wheel effect. The ratio of belt tensions is 3:1. The gear has a 20° tooth form and mesh with another gear located directly above the shaft. If the shaft material selected has an ultimate strength of 500MPa and a yield point of 310 MPa. Determine the necessary diameter using $K_b = 1.5$ and $K_t = 1.0$.

(16 Marks)

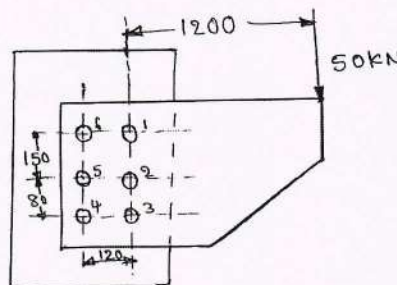
OR

- 6 a. Design a Knuckle joint to connect two mild steel rods subjected to an axial pull of 100kN. The allowable stresses for rods and pin are 100MPa, 130Mpa and 60Mpa in tension , crushing and shear respectively. (08 Marks)
- b. Design a protected type cast iron flange coupling for a steel shaft transmitting 30kW at 200rpm. The allowable shear stress in the shaft and key material is 40MPa. The maximum torque transmitted to be 20% greater than the full load torque. The allowable shear stress in the bolt is 60MPa and the allowable shear stress in the flange is 40MPa. (08 Marks)

Module-4

- 7 a. A double riveted lap joint is to be made between 9mm plate. If the safe working stresses in tension, crushing and shear are 80N/mm^2 , 120N/mm^2 and 60N/mm^2 respectively. Design the riveted joint. (08 Marks)
- b. Determine the diameter of rivet for the joint show in Fig. Q7(b). The allowable stress in the rivets is 100N/mm^2 . (08 Marks)

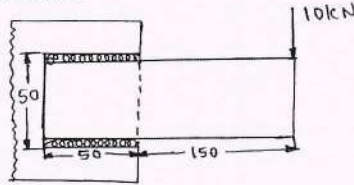
Fig. Q7(b)



OR

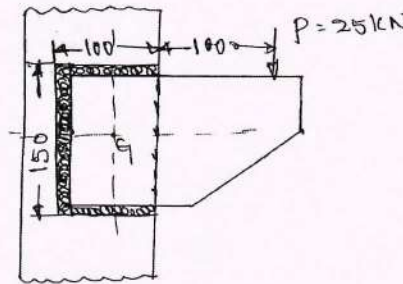
- 8 a. A welded connection of steel plates as shown in Fig. Q8(a), is subjected to an eccentric load of 10kN. Determine the throat dimensions of weld, if the permissible stress is limited to 95N/mm². Assume static conditions. **(08 Marks)**

Fig. Q8(a)



- b. A bracket welded to the support is loaded eccentrically as shown in Fig. Q8(b). The permissible shear stress for the weld material is 60N/mm² and the load is static. Determine the throat and leg dimensions for the weld. **(08 Marks)**

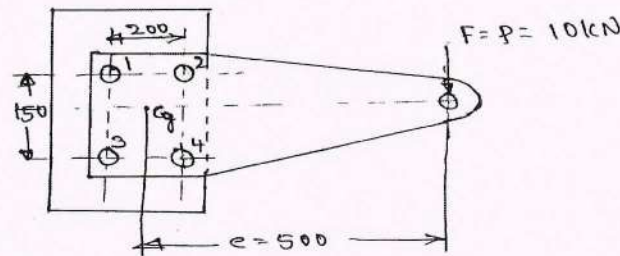
Fig. Q8(b)



Module-5

- 9 a. A flat circular plate is used to close the flanged end of a pressure vessel of internal diameter 300mm. The vessel carries a fluid at a pressure of 0.7N/mm². A soft copper gasket is used to make the joint leak proof. 12 bolts are used to fasten the cover plate onto the pressure vessel. Find the size of bolts so that the stress in the bolts is not to exceed 100N/mm². **(08 Marks)**
- b. The structural connection shown in Fig. Q9(b) is subjected to an eccentric load P of 10kN with an eccentricity of 500mm. The centre distance between bolts are 1 and 3 is 150mm and the centre distance between bolts at 1 and 2 is 200mm. All bolts are identical. The bolts are made of plain carbon steel having yield strength in tension of 400MPa and factor of safety is 2.5. Determine the size of bolts. **(08 Marks)**

Fig. Q9(b)



OR

- 10 a. Explain the self locking and overhauling in power screws. **(04 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 6kN and the mean diameter of the thrust collar is 40mm. The coefficient of friction 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?
- (12 Marks)**

CBGS SCHEME

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15ME564

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021

Project Management

Time: 3 hrs.

Max. Marks: 80

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

Module-1

- 1 a. Define project. Describe the different financial analysis models used for selection of projects. (06 Marks)
b. With a sketch indicating the effort level required at each stage, explain the project life cycle. (10 Marks)

OR

- 2 a. What are the different roles accomplished by the members of a project team? Explain. (06 Marks)
b. Discuss the different knowledge areas identified by PMBOK. (10 Marks)

Module-2

- 3 a. What is meant by project scope? Discuss the steps involved in defining project scope. (06 Marks)
b. Define WBS. Explain the different formats for constructing WBS, with a suitable example. (10 Marks)

OR

- 4 a. What are PERT and CPM? Describe their historical development. (06 Marks)
b. What is Gantt chart? How it is used in project management? (04 Marks)
c. With a suitable example, explain the two pass method for determining critical path. (06 Marks)

Module-3

- 5 a. Briefly explain the ability needed to correctly resource a project by a Project Manager. (06 Marks)
b. Discuss the project team composition issues to be considered when selecting team members. (10 Marks)

OR

- 6 a. Explain the different project cost estimation methods. (06 Marks)
b. With a sketch describe the DMAIC process for achieving quality improvement. (10 Marks)

Module-4

- 7 a. Explain the different types of project procurement contracts. (06 Marks)
b. Discuss planning and conducting procurement in projects. (10 Marks)

OR

- 8 a. What is meant by balanced scorecard approach to project determination? (06 Marks)
b. Explain the probable reasons for terminating the projects early. (05 Marks)
c. Briefly explain the post project activities of the project management. (05 Marks)

1 of 2

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

Module-5

- 9 a. What are AOA and AON diagrams? Differentiate between them with an example. (04 Marks)
 b. The table below shows the information related to a project, for which the indirect cost is Rs.100 per day.

Activity	1-2	1-4	1-3	2-4	3-4	2-5	4-5
Normal time (days)	4	6	2	5	2	6	4
Normal cost (Rs.)	120	300	60	300	200	230	200
Crash time (days)	3	4	1	3	2	5	2
Crash cost (Rs.)	180	500	120	500	200	350	480

- (i) Draw the network of the project.
 (ii) Find the normal duration and normal cost of the project.
 (iii) Calculate the optimum duration and minimum project cost.
 (iv) If all activities are crashed to the maximum possible extent, what will be the project duration and corresponding cost? (12 Marks)

OR

- 10 a. Describe the steps involved in Fulkerson's rule for labeling of nodes. (04 Marks)
 b. The time estimates (in weeks) for the alternatives of a PERT network are given:

Activity	1-2	1-3	1-4	2-5	3-5	4-6	5-6
t_0	1	1	2	1	2	2	3
t_m	1	4	2	1	5	5	6
t_p	7	7	8	1	14	8	15

- (i) Draw the network diagram and calculate the expected project duration.
 (ii) What is the probability that the project will be completed at least 4 weeks earlier than expected time? (12 Marks)

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Module-5

- 9 a. What are AOA and AON diagrams? Differentiate between them with an example. (04 Marks)
b. The table below shows the information related to a project, for which the indirect cost is Rs.100 per day.

Activity	1-2	1-4	1-3	2-4	3-4	2-5	4-5
Normal time (days)	4	6	2	5	2	6	4
Normal cost (Rs.)	120	300	60	300	200	230	200
Crash time (days)	3	4	1	3	2	5	2
Crash cost (Rs.)	180	500	120	500	200	350	480

- (i) Draw the network of the project.
(ii) Find the normal duration and normal cost of the project.
(iii) Calculate the optimum duration and minimum project cost.
(iv) If all activities are crashed to the maximum possible extent, what will be the project duration and corresponding cost? (12 Marks)

OR

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Activity	1-2	1-3	1-4	2-5	3-5	4-6	5-6
t_0	1	1	2	1	2	2	3
t_m	1	4	2	1	5	5	6
t_p	7	7	8	1	14	8	15

- (i) Draw the network diagram and calculate the expected project duration.
(ii) What is the probability that the project will be completed at least 4 weeks earlier than expected time? (12 Marks)

CBCS SCHEME

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15ME564

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021 Project Management

Time: 3 hrs.

Max. Marks: 80

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

Module-1

- 1 a. Define project. Describe the different financial analysis models used for selection of projects. (06 Marks)
b. With a sketch indicating the effort level required at each stage, explain the project life cycle. (10 Marks)

OR

- 2 a. What are the different roles accomplished by the members of a project team? Explain. (06 Marks)
b. Discuss the different knowledge areas identified by PMBOK. (10 Marks)

Module-2

- 3 a. What is meant by project scope? Discuss the steps involved in defining project scope. (06 Marks)
b. Define WBS. Explain the different formats for constructing WBS, with a suitable example. (10 Marks)

OR

- 4 a. What are PERT and CPM? Describe their historical development. (06 Marks)
b. What is Gantt chart? How it is used in project management? (04 Marks)
c. With a suitable example, explain the two pass method for determining critical path. (06 Marks)

Module-3

- 5 a. Briefly explain the ability needed to correctly resource a project by a Project Manager. (06 Marks)
b. Discuss the project team composition issues to be considered when selecting team members. (10 Marks)

OR

- 6 a. Explain the different project cost estimation methods. (06 Marks)
b. With a sketch describe the DMAIC process for achieving quality improvement. (10 Marks)

Module-4

- 7 a. Explain the different types of project procurement contracts. (06 Marks)
b. Discuss planning and conducting procurement in projects. (10 Marks)

OR

- 8 a. What is meant by balanced scorecard approach to project determination? (06 Marks)
b. Explain the probable reasons for terminating the projects early. (05 Marks)
c. Briefly explain the post project activities of the project management. (05 Marks)

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15ME63

Sixth Semester B.E. Degree Examination, Jan./Feb. 2021

Heat Transfer

Time: 3 hrs.

Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.

2. Use of heat transfer data handbook is permitted

Module-1

- 1 a. Define the following terms: i) Convective heat transfer coefficient ii) Thermal diffusivity
iii) Black body iv) Emissivity (04 Marks)
- b. Consider a one dimensional steady state heat conduction in a plate with constant thermal conductivity in a region $0 \leq x \leq L$. A plate is exposed to uniform heat flux 'q' W/M² at $x = 0$ and dissipates heat by convection at $x = L$ with heat transfer coefficient 'h' in the surrounding air at T_∞ . Write the mathematical formulation of this problem for the determination of one dimensional steady state temperature. (04 Marks)
- c. The walls of a house in cold region consists of three layers, an outer brick wall, 15cm thick, an inner wooden panel, 1.2cm thick, the intermediate layer is made of an insulating material, 7cm thick. The thermal conductivities of brick and wood used are 0.7W/mK and 0.18W/mK. The inside and outside temperature of composite wall are 21°C and -15°C. If the layer of insulation offers twice the thermal resistance of the brick wall. Calculate:
 - i) Rate of heat loss per unit area of wall
 - ii) Thermal conductivity of insulating material. (08 Marks)

OR

- 2 a. Derive three dimensional heat conduction equation in cylindrical coordinate system for a isotropic material. (08 Marks)
- b. A plane wall 4cm thick has one of its surfaces in contact with a fluid at 130°C with a surface heat transfer coefficient of 250W/m²K and the other surface is in contact with another fluid at 30°C with a surface heat transfer coefficient of 500W/m²K. The thermal conductivity of wall varies with temperature is given by $K = 20 (1 + 0.001T)$, where T is the temperature. Determine the rate of heat transfer through the wall and surface temperatures of the wall. (08 Marks)

Module-2

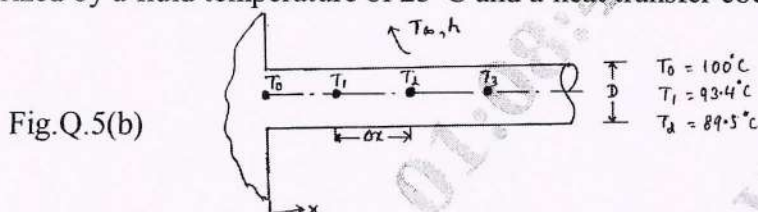
- 3 a. Obtain an expression for temperature distribution through a rectangular fin when the end of fin is insulated. (08 Marks)
- b. An electrical cable of 12mm diameter is insulated to increase the current carrying capacity by 15% without increasing the cable surface temperature above 70°C. The ambient air temperature is 30°C. Calculate the conductivity of insulating material required assuming that the heat transfer coefficient on bare and insulated wire is same as 14W/m²K. (08 Marks)

OR

- 4 a. Show that the temperature distribution in a body during Newtonian heating or cooling is given by $\frac{T - T_\infty}{T_i - T_\infty} = e^{-BiFo}$ (08 Marks)
- b. A steel cylinder 0.2m diameter and 3m long initially at 500°C is suddenly immersed in a fluid at 40°C. The convective coefficient between the cylinder surface and fluid is 200W/m²K. Assume $K = 40W/mK$, $\alpha = 1 \times 10^{-5}m^2/sec$. Calculate after 20 minutes
 - i) Temperature at a radius of 0.05m
 - ii) Heat transferred during 20 mins. (08 Marks)

Module-3

- 5 a. Explain Implicit and Explicit method for discretization of 1-dimensional transient heat conduction problem. (08 Marks)
- b. A steady state, finite difference analysis has been performed on a cylindrical fin with a diameter of 12mm and a thermal conductivity of 15W/mK. The convection process is characterized by a fluid temperature of 25°C and a heat transfer coefficient of 25W/m²K.



- i) The temperatures for the first three nodes, separated by a spatial increment of $x = 10\text{mm}$. Determine the fin heat rate.
- ii) Determine the temperature at node 3, T_3 . (08 Marks)

OR

- 6 a. State: i) Kirchoff's law ii) Stefan Boltzman law iii) Wein's displacement law. (06 Marks)
- b. Calculate the net radiant heat exchange per m² area for two large parallel plates at temperature of 427°C and 27°C respectively. ϵ for hot plates is 0.9 and for cold plate is 0.6. If polished aluminium shield is placed between them. Find the percentage reduction in heat transfer ϵ (shield) = 0.4. (10 Marks)

Module-4

- 7 a. Explain the following:
 i) Velocity boundary layer
 ii) Thermal boundary layer. (06 Marks)
- b. Air at 15°C and 1 atmospheric flows over a cylinder of 400mm diameter and 1500mm height at a velocity of 30km/hr with surface temperature of 45°C. Estimate the rate of heat transfer from the cylinder. (10 Marks)

OR

- 8 a. Obtain fundamental relationship between Nusselt, Prandtl and Grashof numbers applied to natural convection using Buckingham π -theorem. (08 Marks)
- b. A 350mm long glass plate is hung vertically in the air at 24°C, while its temperature is maintained at 80°C. Calculate the boundary layer thickness at the trailing edge of plate. Also calculate the average heat transfer coefficient over the entire length of plate. (08 Marks)

Module-5

- 9 a. Derive an expression for LMTD of parallel flow heat exchanger. (08 Marks)
- b. In a double pipe counter flow heat exchanger, 10,000kg/hr of an oil having specific heat of 2095J/kgK is cooled from 80°C to 50°C by 8000 kg/hr of water entering at 25°C. Determine the heat exchanger area for an overall heat transfer coefficient of 300W/m²K. Take specific heat of water as 4180J/kgK. (08 Marks)

OR

- 10 a. Distinguish between the nucleate boiling and film boiling. (06 Marks)
- b. A tube of 2m length and 25mm outer diameter is to be condense saturated steam at 100°C. While the tube surface is maintained at 92°C. Estimate the average heat transfer coefficient and the rate of condensation of steam if the tube is kept at horizontal. The steam condenses on outside of the tube. (10 Marks)

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15ME64

Sixth Semester B.E. Degree Examination, Jan./Feb.2021

Design of Machine Elements – II

Time: 3 hrs.

Max. Marks: 80

- Note:** 1. Answer any FIVE full questions, choosing ONE full question from each module.
 2. Assume missing data suitably.
 3. Design DHB is permitted to refer.

Module-1

- 1 a. Determine the dimensions of I-section, as shown in Fig. Q1 (a) in which maximum fiber stresses are numerically equal in pure bending. Given $b_1 + b_0 = 120$ mm (12 Marks)

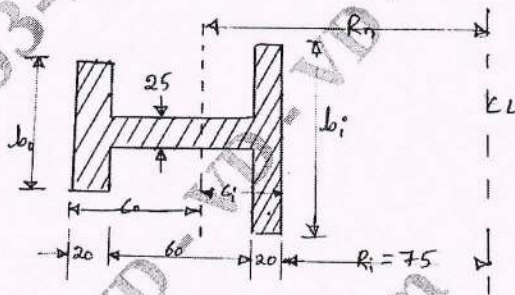


Fig. Q1 (a)

- b. A thin cylinder of diameter 600 mm and 10 mm wall thickness is subjected to internal pressure of 1.5 MPa. Find the stresses induced in the wall. (04 Marks)

OR

- 2 a. A 100 mm inside and 150 mm outside sleeve is press fitted on to a shaft of 100 mm diameter, take $E = 210$ GPa, Poissons ratio of 0.28. The contact pressure is not to exceed 60 MPa. Determine
- (i) The tangential stresses at the inner and outer surface of the sleeve and outside diameter of the shaft.
 - (ii) The radial stresses in the sleeve and shaft.
 - (iii) The original diameters of the shaft and hub before press fit. (12 Marks)
- b. Discuss the differences between straight and curved beam. (04 Marks)

Module-2

- 3 a. A leathers belt $9\text{mm} \times 250\text{mm}$ is used to drive a cast iron pulley 90 cm in diameter at 336 rpm. If the active arc of contact on the smaller pulley is 120° and the stress in the tight side is 2 MPa, find the power capacity of the belt which weighs 0.00098 kg/cm^3 , $m = 0.35$ of leather. (12 Marks)
- b. Discuss types of power transmission chaines. (04 Marks)

OR

- 4 The inlet valve of an IC engine operated by a spring exerts a force of 250 N when the valve is closed and 450 N when the valve is open. The lift is 8 mm. The material test gives the following results. $\sigma_y = 600$ MPa, Endurance stress in tortion $\tau_{-1} = 450$ MPa, $G = 80$ GPa,

$$C = \frac{D}{d} = 6, F.S = 1.5$$

(16 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.

Module-3

- 5 Design a pair of spur gears to transmit 24 kW at 1000 rpm to a parallel shaft to be rotated at 400 rpm. The center distance between the shaft is 175 mm. Assume $\alpha = 20^\circ$ FDI. Select cast steel for both gears ($\sigma_p = \sigma_g = 138$ MPa). (16 Marks)

OR

- 6 a. Define formative number of teeth for Bevel gears. (02 Marks)
 b. A pair of Bevel gears transmitting 7.5 kW at 300 rpm of pinion. The pressure angle is 20° . The pitch diameters of pinion and gear at their large ends are 150 mm and 200 mm respectively. The face width of the gear is 40 mm. Determine the components of the resultant gear tooth forces acting on the pinion and the gear. (14 Marks)

Module-4

- 7 Design a worm gear drive to transmit 12 kW at 1200 rpm. The speed reduction designed is 30 : 1. The worm is made of hardened steel of $\sigma_0 = 210$ MPa and gear of phosphor bronze of $\sigma_0 = 90$ MPa. The teeth are $14 \frac{1}{2}^\circ$. Check the heat capacity of the gear. (16 Marks)

OR

- 8 a. Discuss the types of clutches and their applications. (06 Marks)
 b. A simple Band brake of drum, diameter 600 mm has a band passing over it with an angle of contact 225° . While one end is connected to the fulcrum, the other end is connected to the Break lever at a distance of 400 mm from the fulcrum. The brake lever is 1 m long. The brake is to absorb a power of 15 kW at 720 rpm. Design the break lever of rectangular cross section, assuming depth to be thrice the width. Take $\sigma_b = 80$ MPa. (10 Marks)

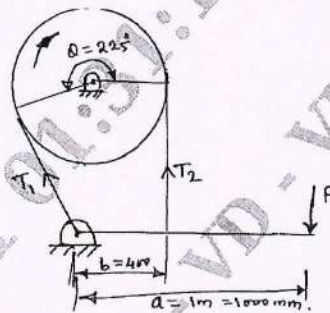


Fig. Q8 (b)

Module-5

- 9 a. A Journal bearing 75 mm long supports a load of 7.3 kN on a 50 mm diameter journal turning at 750 rev/min. The diametral clearance is 0.07 mm, what should be the viscosity of the oil if the operating temperature of the bearing surface is to be limited to 75°C when still air is at 20°C . (12 Marks)
 b. Explain types of roller contact bearings. (04 Marks)

OR

- 10 Select a suitable ball-bearing required to be mounted on a shaft of diameter 45 mm to withstand a radial load of 6 kN and a load of 3 kN at a rated speed of 300 rpm. The bearing works for 50 hours/week for 3 years. Assume light shocks. (16 Marks)

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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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18ME52

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)

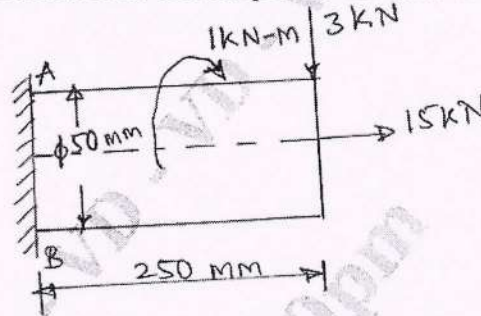


Fig. Q1 (c)

- 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)

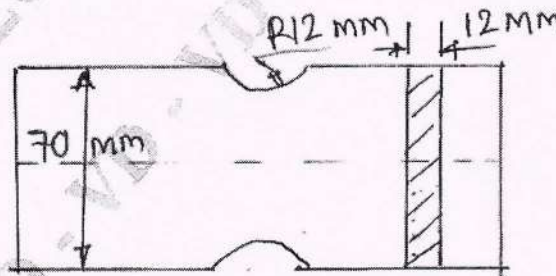


Fig. Q2 (b)

- 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)

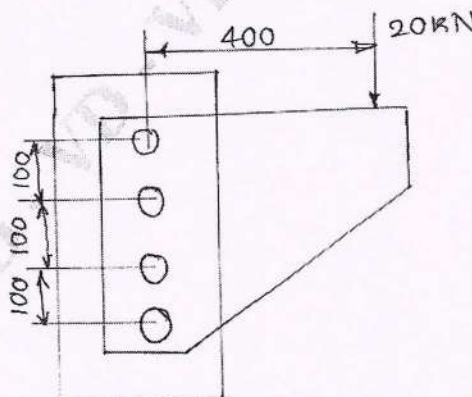


Fig.Q7 (b)

- 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)

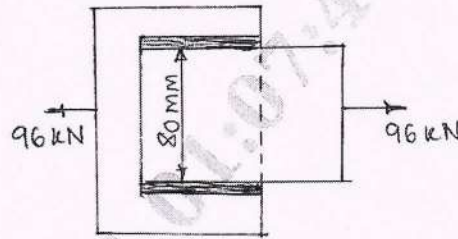


Fig. Q8 (a)

- 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)

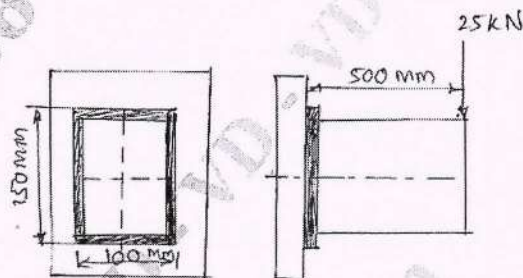


Fig. Q8 (b)

- 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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18ME53

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)

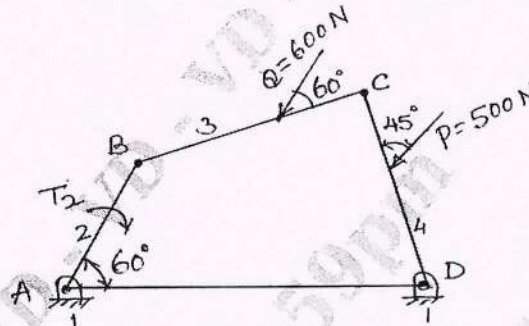


Fig.Q.1(b)

- 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)

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.

- 4 a. Explain the terms primary balancing and secondary balancing as used for balancing of reciprocating masses. (10 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)

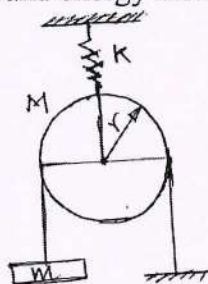


Fig.Q.7(b)

- 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 moves 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
- Force transmitted to the foundation at 800rpm.
 - Force transmitted to the foundation at resonance.
 - 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
- Dunkerley's method
 - 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/m²
 Permissible stress in shaft material = 70×10^6 N/m²
 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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18ME54

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)

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.

- 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 a. Define fluid power technology. Mention the advantages and applications of fluid power system. (06 Marks)
b. What is Pascal's law? Explain the concept of force multiplication. (06 Marks)
c. Write notes on:
(i) Sealing materials
(ii) Pressure drop in hoses/pipes (08 Marks)
- 2 a. Explain the desirable properties of hydraulic fluids in industrial hydraulic systems. (08 Marks)
b. Explain the various filter locations used in filtering in hydraulic systems. (06 Marks)
c. Write a note on hoses and quick acting couplings. (06 Marks)
- 3 a. 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)
b. Write a note on performance characteristics of gear pump. (05 Marks)
c. Explain briefly the gas loaded type of accumulator with a neat sketch. (05 Marks)
- 4 a. Explain the working of cushioning and telescopic cylinders with a neat sketch with suitable applications. (10 Marks)
b. 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:
(i) Speed of the motor
(ii) Theoretical torque
(iii) Theoretical power of the motor (06 Marks)
c. Mention the difference between:
(i) Hydraulic pump and hydraulic motor
(ii) Linear Actuator and Rotary Actuator (04 Marks)
- 5 a. 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)
b. Discuss the working of pressure compensated flow control valve with a neat sketch. (06 Marks)
c. Give the symbolic representation of :
(i) Pressure relief valve
(ii) Pressure reducing valve (05 Marks)
- 6 a. Explain the following with a neat hydraulic circuits:
(i) Force Multiplication Circuit
(ii) Sequencing Circuit (16 Marks)
b. 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
(ii) Exhaust Air Throttling (06 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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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?
- (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.
- (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

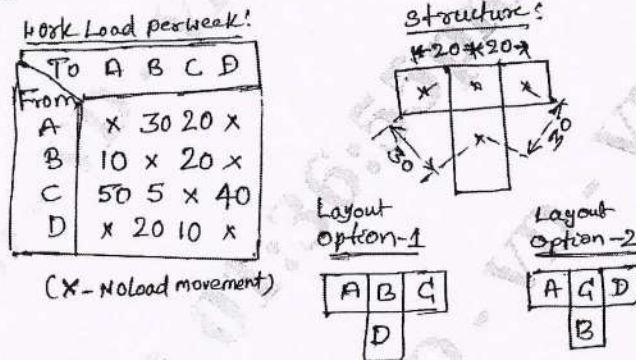
- (i) Compute the coefficients a and b for the regression line.
- (ii) Suppose the manager pans to drive 250000 kms, what is the expected number of tyres which will be used? (08 Marks)

- 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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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)

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 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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17ME52

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

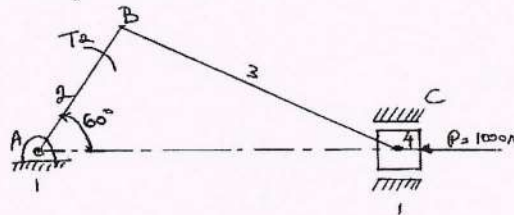
Dynamics of Machinery

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)

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.

- 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:
- Simple Harmonic Motion (SHM).
 - Degrees of freedom.
 - Phase difference.
 - Resonance.
 - 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
- Amplitude of machine
 - Phase angle with respect to exciting force.
 - Transmissibility and force transmitted to foundation.
 - Phase angle of transmitted force with respect to exciting force.
- (12 Marks)

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17ME53

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 1565l/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

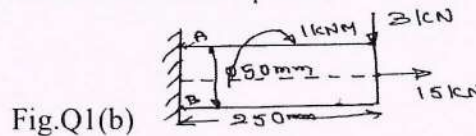
Fifth Semester B.E. Degree Examination, July/August 2021 Design of Machine Elements – I

Time: 3 hrs.

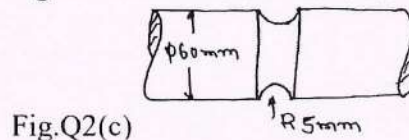
Max. Marks: 100

- 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)

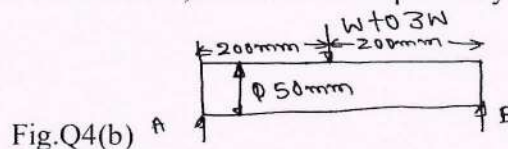


- 2 a. What is stress concentration? Explain the factors affecting the stress concentration. (04 Marks)
b. State and explain the theories of failure applicable to (i) ductile (ii) brittle material. (04 Marks)
c. Determine the maximum stress induced in the semi circular grooved shaft shown in Fig.Q2(c), 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.



- 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 in 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)



- 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 .

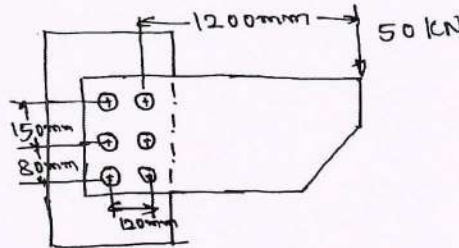


Fig.Q7(b)

(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.

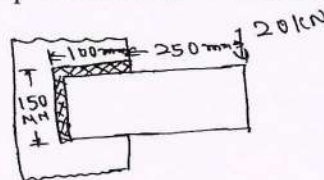


Fig.Q8(b)

(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.

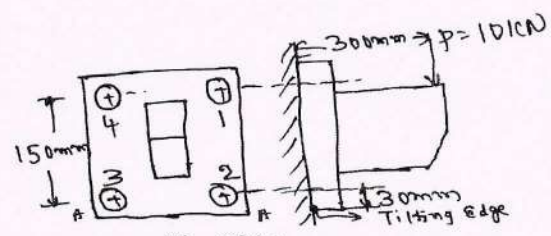


Fig.Q9(a)

(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)

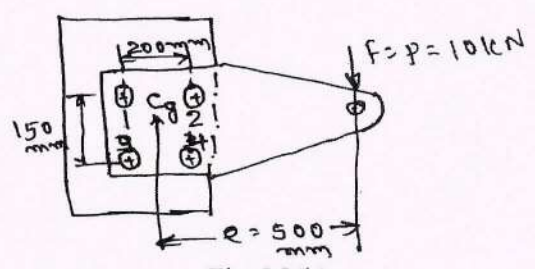


Fig.Q9(b)

- 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
- (i) Torque required to raise the screw against load.
 - (ii) Torque required to lower the screw with the load.
 - (iii) Overall efficiency
 - (iv) Is this screw self-locking.

(15 Marks)

CBCS SCHEME

USN

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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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CBCS SCHEME

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17ME564

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

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions.

- 1 a. Define project. Explain different characteristics of a project. (06 Marks)
 b. List and explain the different types of projects. (10 Marks)
 c. Explain different roles of a project manager. (04 Marks)

- 2 a. List and explain the methods of selecting projects. (06 Marks)
 b. List and explain the different types of strategic analysis. (10 Marks)
 c. Briefly explain the strategic objectives. (04 Marks)

- 3 a. Explain project scope check list with suitable example. (08 Marks)
 b. What is project planning? Explain the steps involved in project planning. (05 Marks)
 c. What is project schedule? List the main purpose of a project schedule in the organization. (07 Marks)

- 4 a. Define Work Breakdown Structure (WBS). Explain briefly the coding of WBS with suitable example. (10 Marks)
 b. Write a note on Gantt chart. (04 Marks)
 c. List and explain the steps to develop a project schedule. (06 Marks)

- 5 a. List and explain the estimate resource needs. (06 Marks)
 b. List and explain the abilities needed when resourcing projects. (06 Marks)
 c. List and explain the steps involved in developing a staffing management plan. (08 Marks)

- 6 a. Define Risk Management Planning. Briefly explain the steps involved in risk management planning. (10 Marks)
 b. Write short notes on:
 (i) Kickoff project
 (ii) Cost estimating
 (iii) Cost budgeting (10 Marks)

- 7 a. Define project supply management. Explain the different stages involved in project supply chain management. (10 Marks)
 b. Explain the concept of project partnering and collaborating in performing projects. (06 Marks)
 c. Write a note on internal and external project. (04 Marks)

- 8 a. What is project balanced scorecard? With a flow chart, explain project balanced scorecard approach. (10 Marks)
 b. List and explain the different ways to finish projects on time. (05 Marks)
 c. With a block diagram, briefly explain the knowledge management. (05 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.

- 9 a. Define an arrow diagram and explain “Fulkerson’s” rule for numbering the events in network diagram. (08 Marks)

- b. A project has the following time schedule:

Activity	1 - 2	1 - 3	1 - 4	2 - 5	3 - 6	3 - 7	4 - 6	5 - 8	6 - 9	7 - 8	8 - 9
Duration (months)	2	2	1	4	8	5	3	1	5	4	3

Construct the network diagram and compute:

- (i) Critical path and its duration
 (ii) Total float for each activity

(12 Marks)

- 10 a. Write a note on PERT and CPM. (04 Marks)

- b. List and explain the different types of floats. (06 Marks)

- c. A small project is composed of seven activities whose time estimates are listed in the table as follows:

Activity	1 - 2	1 - 3	1 - 4	2 - 5	3 - 5	4 - 6	5 - 6
t_o	1	1	2	1	2	2	3
t_m	1	4	2	1	5	5	6
t_p	7	7	8	1	14	8	15

- (i) Draw the project network.
 (ii) Find the expected duration and variance and each activity
 (iii) Calculate the variance and standard deviations of project length.

(10 Marks)

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