CBCS SCHEME

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15ME51

Fifth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Management and Engineering Economics

Time: 3 hrs. Max. Marks: 80

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

Module-1

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

OR

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

Module-2

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

OR

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

Module-3

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

OR

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

Module-4

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

OR

8 a. Explain briefly rate of return, MARR, IRR and ERR. **(08 Marks)**

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

Module-5

9 a. Briefly explain the varies elements of cost. **(08 Marks)**

b. BOSH company produces 500 spark plugs/day, involving direct material cost of Rs.40,000. Direct labour cost of Rs.35,000 and factory overheads of Rs.10000. Assuming a profit of 15% of the selling price and selling overheads to be 30% of the factory cost. Find the selling price of one spark plug. **(08 Marks)**

OR

10 a. What is depreciation? Explain the causes of depreciation. **(08 Marks)**

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

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15ME52

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

Time: 3 hrs. Max. Marks: 80

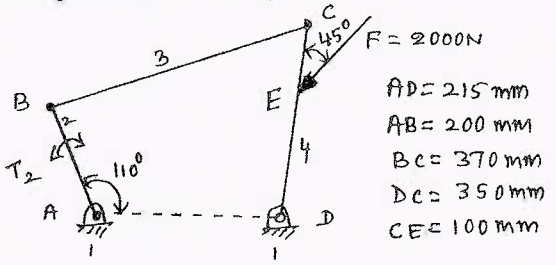
Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

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

b. For the 4 bar mechanism shown in Fig.Q.1(b), find the required torque T_2 and various P in forces on the links for the equilibrium of the system. **(10 Marks)**

Fig.Q.1(b)



OR

2 a. Explain D'Alemerts principle and state its significance. **(04 Marks)**

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

Module-2

3 a. What do you mean by static and dynamic balancing? **(04 Marks)**

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

OR

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

Module-3

5 a. Explain the following terms relative to governors: i) Stability ii) Sensitiveness iii) Isochronism iv) Hunting. **(08 Marks)**

b. A porter governor has equal arms each 250mm long and pivoted on the axis of rotation. Each ball has a mass of 5kg and the mass of the central load on the sleeve is 15kg. The radius of rotation of the ball is 150mm when the governor begins to lift and 200mm when the governor is at maximum speed. Find the minimum and maximum speeds and the range of speed of the governor. **(08 Marks)**

OR

6 a. With neat sketches, explain the effect of gyroscopic couple on steering, pitching and rolling of a ship. **(06 Marks)**

b. An aeroplane flying at 240km/h turns towards the left and completes a quarter circle of 60m radius. The mass of the rotor engine and the propeller of the plane is 450kg with a radius of gyration of 320mm. The engine speed is 2000 rpm clockwise when viewed from the rear. Determine the gyroscopic couple on the aircraft and its effect. In what way is the effect changed when the

i) Aeroplane turns towards right

ii) Engine rotates clockwise when viewed from the front (nose end) and the aeroplane turns left and right. **(10 Marks)**

Module-4

7 a. Add the following harmonic motions analytically and check the solutions graphically:

$x_1 = 4 \cos (wt + 10°)$

$x_2 = 6 \sin (wt + 60°)$ **(08 Marks)**

b. Find the natural frequency of the system shown in the Fig.Q.7(b) using energy method. **(08 Marks)**

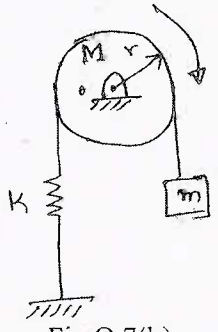


Fig.Q.7(b)

OR

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

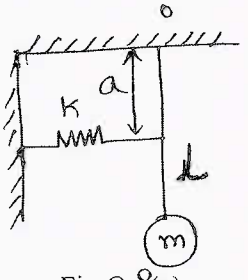


Fig.Q.8(a)

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

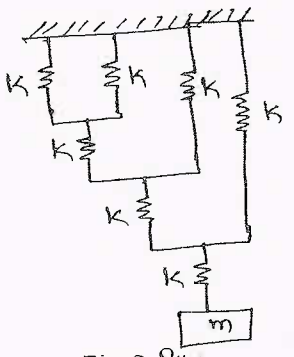


Fig.Q.8(b)

Module-5

9 a. Set up the differential equation for a spring mass damper system and obtain complete solution for the critically damped condition. **(08 Marks)**

b. Determine:

i) Critical damping coefficient
ii) Damping factor
iii) Natural frequency of damped vibrations
iv) Logarithmic decrement
v) Ratio of two consecutive amplitude of vibrating system which consists of mass of 25kg, a spring of stiffness 15 kN/m and a damper. The damping provided is only 15% of the critical value. **(08 Marks)**

OR

10 a. Define transmissibility and derive an expression for the transmissibility ratio and the phase angle for transmitted force. **(08 Marks)**

b. A machine of mass one ton is acted upon by an external force 2450N at a frequency of 1500rpm. To reduce the effects of vibration, isolator and rubber having a static deflection of 2mm under the machine load and an estimated damping factor of 0.2 are used. Determine :

i) Force transmitted to the foundation
ii) Amplitude of vibration of the machine
iii) Phase lag of the transmitted force with respect to the external force. **(08 Marks)**

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15ME53

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

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Differentiate between turbo machines and positive displacement machines. **(08 Marks)**

b. Test on a turbomachine runner 1.25 m in diameter at 30 m head gave the following results. Power developed = 736 KW. Speed is 180 rpm and discharge 2.7 m^3/s. Find the diameter, speed and discharge of a runner to operate at 45 m head and give 1472 KW at the same efficiency. What is specific speed of both the turbines? **(08 Marks)**

OR

2 a. Show that the polytropic efficiency during the expansion process is given by

$$\eta_p = \frac{\ln\left[\frac{T_2}{T_1}\right]}{\frac{\gamma-1}{\gamma}\ln\left[\frac{P_2}{P_1}\right]}.$$ **(08 Marks)**

b. A stream of combustion gases at the point of entry to a turbine has a static temperature of 1050 K, static pressure of 600 kPa, and a velocity of 150 m/s. For the gases, C_p = 1.004 kJ/kgK and γ = 1.41. Find the total temperature and total pressure of the gases. Also find the difference between their static and total enthalpies. **(08 Marks)**

Module-2

3 a. Derive alternate form of Euler equation and explain each component in that. **(08 Marks)**

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

OR

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

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

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

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

i) Blade angle at rotor and stator inlet.

ii) Power required to derive the compressor. **(08 Marks)**

Module-3

5 a. What is compounding? Explain any two methods of compounding. **(08 Marks)**

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

OR

6 a. Derive the condition for maximum efficiency of reaction steam turbine and hence prove that $\eta_{b\,max} = \frac{2\cos^2\alpha_1}{1+\cos^2\alpha_1}$. **(08 Marks)**

b. A Parson's turbine is running at 1200 rpm. The mean rotor diameter is 1m. Blade outlet angle is 23°, speed ratio is 0.75. Stage efficiency is 0.8. Find enthalpy drop in this stage. **(08 Marks)**

Module-4

7 a. Show that for maximum efficiency of pelton wheel the bucket velocity is equal to half of the jet velocity $U = \frac{V_1}{2}$. **(08 Marks)**

b. In a power station, a pelton wheel producer 15000 KW under a head of 350 m, while running at 500 rpm. Assume a turbine efficiency of 0.84, coefficient of velocity for nozzle as 0.98, speed ratio 0.46 and bucket velocity coefficient 0.86. Calculate: (i) Number of jet (ii) Diameter of each jet (iii) Tangential force on the buckets if the bucket deflect the jet through 165°. **(08 Marks)**

OR

8 a. With a mathematical expression, define the following:

i) Hydraulic efficiency ii) Mechanical efficiency

iii) Overall efficiency iv) Volumetric efficiency **(08 Marks)**

b. A Kaplan turbine working under a head of 20 m develops 11772 KW shaft power. The outer diameter of the runner is 3.5 m and hub dice is 1.75 m. The guide blade angle at the extreme edge of the runner is 35°. The hydraulic and overall efficiency of the turbine are 88% and 84% respectively. If the velocity of whirl is zero at outlet, determine:

i) Runner vane angles at inlet and outlet at the extreme edge of the runner

ii) Speed of the turbine. **(08 Marks)**

Module-5

9 a. Define the following:

i) Suction head ii) Delivery head

iii) Manometric head iv) Net positive suction head **(08 Marks)**

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

OR

10 a. For axial flow compressor show that $E = v_f u\left[\frac{\tan\beta_2 - \tan\beta_1}{\tan\beta_1 \tan\beta_2}\right]$. **(08 Marks)**

b. What are the types of diffuses used in centrifugal compressor? Explain any two. **(08 Marks)**

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15ME54

Fifth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Design of Machine Elements – I

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. List the factors which govern the selection of appropriate material for a machine component. **(05 Marks)**

b. A stepped shaft with its diameter reduced for '2d' to 'd' has a fillet radius of 0.1d. Determine the diameters of the shaft and the radius of the fillet to transmit a power of 65 KW at a rated speed of 1440 rpm limiting the shear stress induced to 60 MPa. **(11 Marks)**

OR

2 a. Define stress concentration and show how stress concentration can be reduced for two examples with neat sketches. **(06 Marks)**

b. A cantilever beam of rectangular cross section with a depth of 150 mm is subjected to an axial tensile load of 40 kN and a transverse load of 50 kN acting downwards at the free end of 600 mm length beam. The material of the beam has allowable tensile stress of 100 MPa. Determine the width of rectangular section of the beam. **(10 Marks)**

Module-2

3 a. Derive an expression for impact stress induced in a member subjected to axial load. **(06 Marks)**

b. A piston rod of steam engine is subjected to a completely reversed axial load of 50 kN. The material of rod has an yield normal stress of 310 N/mm^2 and endurance stress of 289 N/mm^2. Assuming load factor of 0.7, size factor as 1 and surface finish factor as 1. Determine the diameter of rod. Choose factor of safety as 2. **(10 Marks)**

OR

4 a. Derive Soderberg's relation for a member subjected to fatigue loading. **(06 Marks)**

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

Module-3

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

OR

6 a. Design a cotter joint to join two round rods capable of sustaining an axial load of 100 kN. The material of the joint has design tensile stress = 100 N/mm^2, crushing stress = 150 N/mm^2 and shear stress = 60 N/mm^2. **(08 Marks)**

b. A cast iron flange coupling is used to connect two shafts of 80 mm diameter. The shaft runs at 250 rpm and transmits a torque of 2500 N-m. The permissible shear stress for shaft material and bolt materials is 50 MPa and permissible shear stress for flange is 20 MPa. Design the bolts and the flange. Also select suitable key for the coupling. Take allowable normal stress for bolt as 100 MPa. **(08 Marks)**

Module-4

7 a. Design a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5 m in diameter subjected to a steam pressure of 0.95 N/mm^2. Assume an efficiency of 72%, allowable tensile stress in the plate of 90 N/mm^2, crushing stress of 140 N/mm^2 and an allowable shear stress in the rivet of 50 N/mm^2. **(08 Marks)**

b. Determine the size of weld required for an eccentrically loaded weld as shown in Fig.Q7(b). The allowable stress in the weld is 75 MPa.

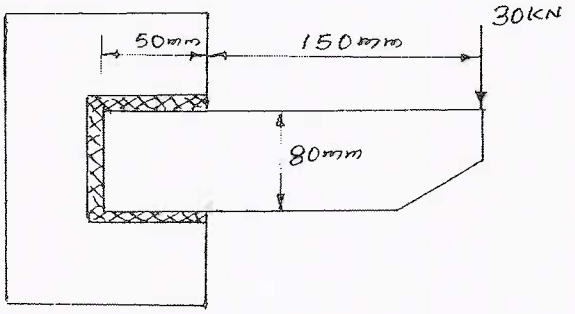

Fig.Q7(b) **(08 Marks)**

OR

8 a. Two lengths of a flat tie bar for a bridge structure of 250 mm wide and 18 mm thick are connected by a diamond joint with equal cover plates on either side. Design the joint completely working stresses for the material of the bar are 100 MPa in tension, 70 MPa in shear and 160 MPa in crushing. **(08 Marks)**

b. One end of a rectangular bar of cross section 120 mm × 70 mm is welded to a vertical support by four fillet welds along its circumference. A steady transverse load of 10 kN is applied at the free end of the bar of length 160 mm and is parallel to 120 mm side. Determine the size of weld, if the allowable stress in the material is limited to 115 MPa. **(08 Marks)**

Module-5

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

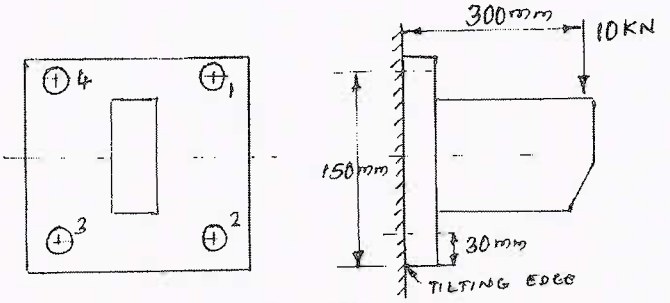

Fig.Q9(a) **(08 Marks)**

b. A square threaded power screw has a nominal diameter of 30 mm and a pitch of 6 mm with double threads. The load on the screw is 6 kN and the mean diameter of the thrust collar is 40 mm. the coefficient of friction for the screw is 0.1 and the collar is 0.09. Determine:
   i) Torque required to raise and lower the screw with load
   ii) Overall efficiency **(08 Marks)**

OR

10 A screw jack is to lift a load of 80 kN through a height of 400 mm ultimate strength of screw material in tension and compression is 200 N/mm^2 and in shear 120 N/mm^2. The material for the nut is phosphor bronze for which the ultimate strength is 100 N/mm^2 in tension and 90 N/mm^2 in compression and 80 N/mm^2 in shear. The bearing pressure between the nut and the screw is not to exceed 18 N/mm^2. Design the screw and nut and check for stresses. Take FOS = 2, $\mu = 0.14$. Design jack for 25% overload. **(16 Marks)**

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15ME51

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

Time: 3 hrs. Max. Marks: 80

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

Module-1

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

OR

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

Module-2

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

OR

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

Module-3

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

OR

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

Module-4

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

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

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

OR

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

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

Module-5

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

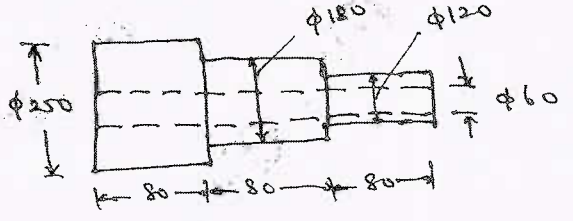
b. Explain the importance of estimating and costing. **(04 Marks)**

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

OR

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

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



All dimensions in mm
Fig.Q10(b)

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15ME53

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

Time: 3 hrs. Max. Marks: 80

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

Module-1

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

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

OR

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

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

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

Module-2

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

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

OR

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

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

Module-3

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

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

OR

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

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

Module-4

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

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

OR

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

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

Module-5

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

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

OR

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

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

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CBCS SCHEME

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15ME54

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

Time: 3 hrs. Max. Marks: 80

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

Module-1

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

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

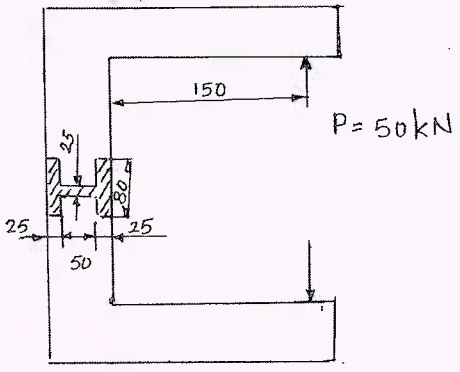

Fig.Q1(b)

All dimensions are in mm.

OR

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

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

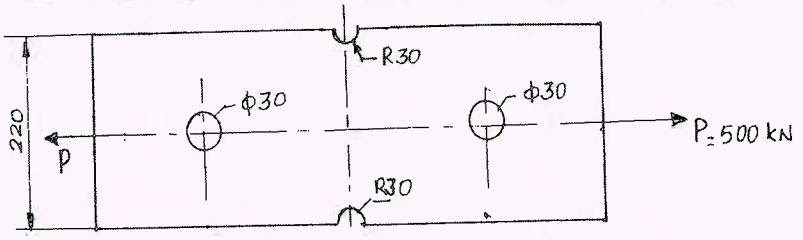

Fig.Q2(b) **(10 Marks)**

Module-2

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

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

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

OR

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

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

Module-3

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

OR

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

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

Module-4

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

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

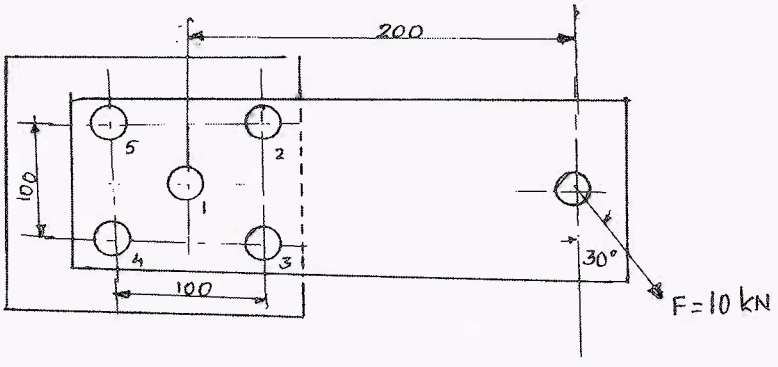

Fig.Q7(b) **(08 Marks)**

OR

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

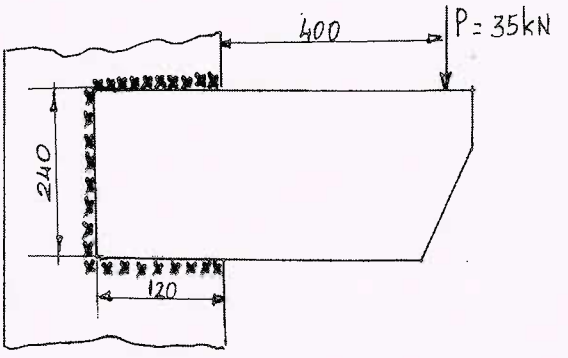

Fig.Q8(a) **(08 Marks)**

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

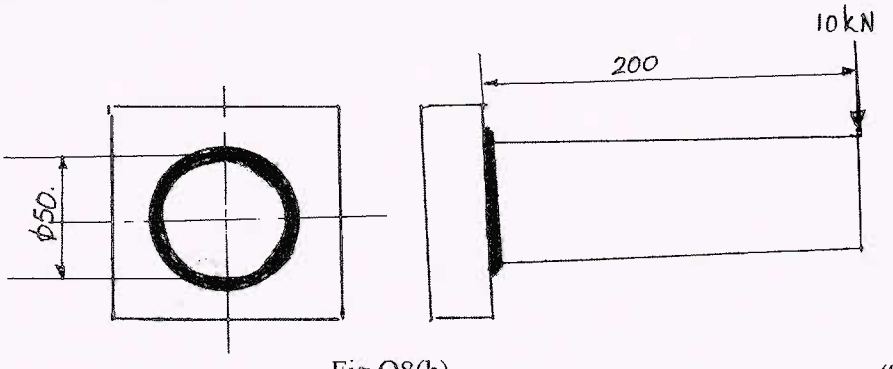

Fig.Q8(b) **(08 Marks)**

Module-5

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

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

OR

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

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

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

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CBCS SCHEME

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15ME61

Sixth Semester B.E. Degree Examination, June/July 2019
Finite Element Analysis

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain the steps involved in FEM. **(08 Marks)**

b. Discuss the convergence and compctability requirements of elements. **(08 Marks)**

OR

2 a. Explain the importance of Node numbering scheme. **(06 Marks)**

b. What are simple, complex and multiplex elements? **(10 Marks)**

Module-2

3 a. Derive the shape function for quadratic 1D bar element. **(06 Marks)**

b. Find the nodal displacement stress and reaction for the bar subjected to load as shown in Fig.Q3(b). Take E_1 = 70 GPa and E_2 = 200 GPa. **(10 Marks)**

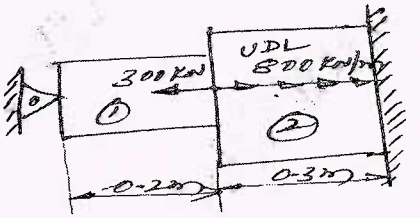

Fig.Q3(b)

OR

4 a. Explain isoparametric, sub-parametric and superparametric elements. **(06 Marks)**

b. For the two-bar truss shown in Fig.Q4(b), determine the displacements, stress in each elements and reactions at the support. **(10 Marks)**

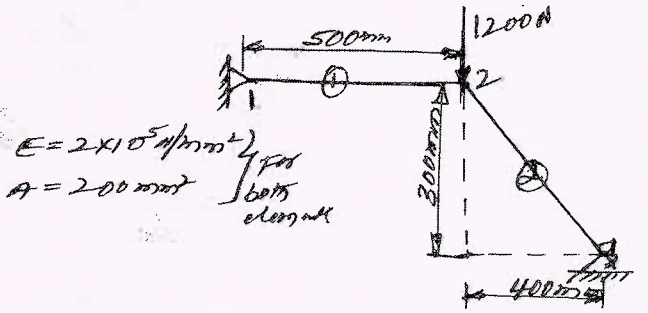

Fig.Q4(b)

Module-3

5 a. Derive the Hermite function for beam element. **(08 Marks)**

b. A cantilever beam subjected to a point load of 250 kN as shown in Fig.Q5(b). Determine the deflection at the free end and the support reactions. Take E = 200 GPa, I = 4×10^6 mm^4. **(08 Marks)**

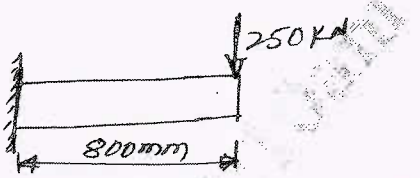

Fig.Q5(b)

OR

6 a. Explain the finite element formation of shaft. **(06 Marks)**

b. A bar of circular cross section having a diameter of 50 mm is firmly fixed at its ends and subjected to a torque as shown in Fig.Q6(b). Determine maximum angle of twist and shear stress. Take $G = 7\times10^4$ N/mm^2 and $E = 2\times10^5$ N/mm^2. **(10 Marks)**

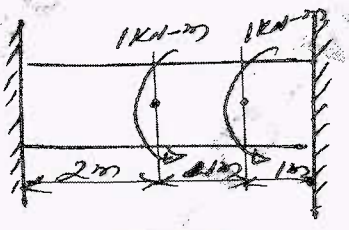

Fig.Q6(b)

Module-4

7 a. Explain the differential equation for an 1D-heat conduction. **(04 Marks)**

b. A composite slab consists of three materials with thermal conductivities of 20 W/m °C, 30 W/m °C, 50 W/m °C and thickness 0.3m, 0.15m and 0.15m respectively as shown in Fig.Q7(b). The outer surface is at 20°C and the inner surface is exposed to the convective heat transfer coefficient of 25 W/m^2 °C and a medium at 800°C. Determine the temperature distribution within the wall. **(12 Marks)**

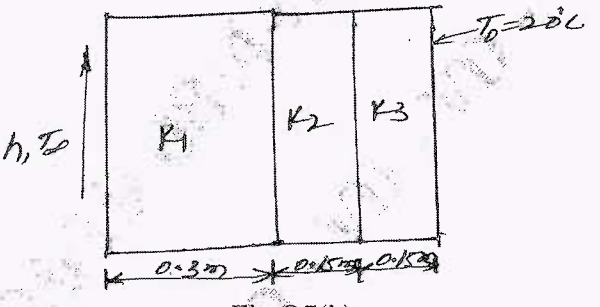

Fig.Q7(b)

OR

8 a. Derive the stiffness matrix for 1-D element with two-nodes having nodal fluid heads. **(06 Marks)**

b. For the smooth pipe with uniform cross-section of 1m^2 as shown in Fig.Q8(b). Determine the flow velocities at the center and right end, by knowing the velocity at the left is $V_x = 2$m/sec. **(10 Marks)**

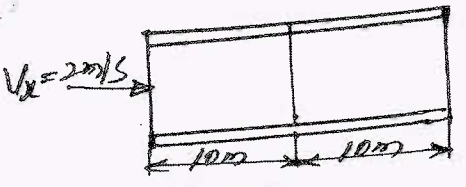

Fig.Q8(b)

Module-5

9 a. Derive the stiffness matrix of axisymmetric bodies with triangular element. **(12 Marks)**

b. For the element of an axisymmetric body rotating with a constant angular velocity w = 1000 rev/min as shown in Fig.Q9(b). Determine the body force vector. Include the weight of the material, $\rho = 7850\ kg/m^3$. **(04 Marks)**

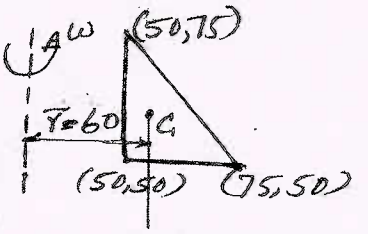

Fig.Q9(b)

OR

10 a. Differentiate between lumped mass matrix and consistent mass matrix. **(06 Marks)**

b. Device consistent mass matrix for truss element. **(10 Marks)**

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CBCS SCHEME

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15ME62

Sixth Semester B.E. Degree Examination, June/July 2019
Computer Integrated Manufacturing

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define automation. Explain different types of automation. **(08 Marks)**

b. Explain the product life cycle mathematical models. **(08 Marks)**

OR

2 a. What is buffer storage? What are the reasons for implementing buffer storage in an automated production line? **(04 Marks)**

b. Explain Upper bound approach in analysis of flow line without storage buffer. **(03 Marks)**

c. A 20 station transfer line has two stages of 10 stations each. The ideal cycle time of each stage is 1.2 min. all the stations in the line have the same probabilities of stopping, p = 0.005. Assume that the downtime 8 min is constant when a breakdown occurs. Using upper bound approach, compute the line efficiency for the buffer stage capacities of (i) b = 0 (ii) b = ∞ (iii) b = 10 (iv) b = 100. **(09 Marks)**

Module-2

3 a. Explain the design process using computer aided design with a neat block diagram. **(09 Marks)**

b. Explain scaling in geometric models transformations. **(07 Marks)**

OR

4 a. Explain generative type process planning system and list the advantages of CAPP. **(08 Marks)**

b. Write a note on Material Requirement Planning and shop floor control. **(08 Marks)**

Module-3

5 a. Explain Flexible Manufacturing Cell with a sketch. **(06 Marks)**

b. State and explain the components of Flexible Manufacturing System. **(10 Marks)**

OR

6 a. Briefly explain the following: i) Minimum rational work element ii) Precedence diagram iii) Cycle time **(06 Marks)**

b. In a plant a product is to be assembled as per the following information: **(10 Marks)**

Elements	Time (Te) min	Immediate Predecessor
1	5	-
2	3	1
3	8	1
4	2	2
5	1	2
6	6	3
7	4	4, 5
8	5	3, 5
9	3	7, 8
10	6	6, 9

i) Construct the precedence diagram.

ii) If the cycle time is 10 min. what is the number of stations required?

iii) Compute the balance delay of the line by using Largest Candidate Rule method.

Module-4

7 a. What do you mean by cutter radius compensation in CNC programming? Briefly explain. **(02 Marks)**

b. Write different M-codes used in programming and their functions. **(04 Marks)**

c. Write a turning centre part program for the part shown in Fig.Q7(c). Use one finish cut and rest rough cut to remove the material. Use the following information.

Operation	Tool No.	Onset Register	Cutting speed (m/min)	Feed (mm/rev)
Rough cut	T01	10	200	0.4
Finishing	T02	12	300	0.2

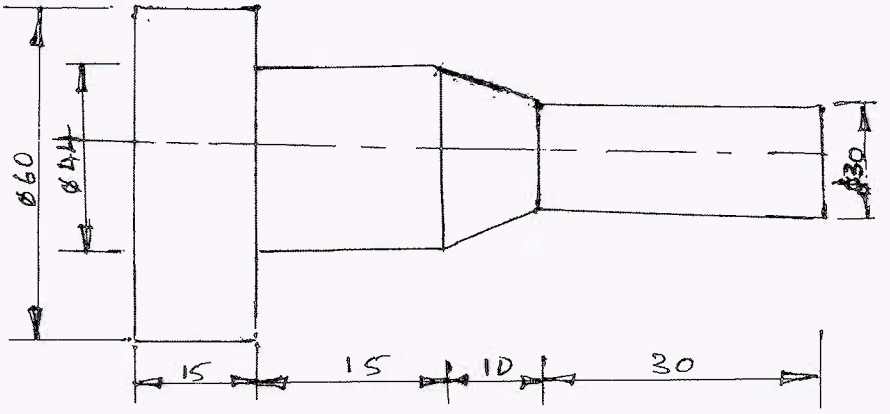

Fig.Q7(c) **(10 Marks)**

OR

8 a. Sketch and explain common robot configurations. **(10 Marks)**

b. Mention the different types of grippers. **(02 Marks)**

c. Explain lead through method of robot programming. **(04 Marks)**

Module-5

9 a. What is additive manufacturing? Explain the basic principles involved in additive manufacturing. **(10 Marks)**

b. List the advantages of additive manufacturing. **(06 Marks)**

OR

10 a. Write a note on Internet of Things. **(08 Marks)**

b. How these AM processes are carried out:

i) Binder Jetting

ii) Direct energy Deposition

iii) Material Jetting

iv) Hybrid Manufacturing **(08 Marks)**

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CBCS SCHEME

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15ME63

Sixth Semester B.E. Degree Examination, June/July 2019
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 hand book and steam tables are permitted.

Module-1

1 a. State the laws governing three basic modes of heat transfer. **(06 Marks)**

b. Derive the general three-dimensional conduction equation in Cartesian coordinates and state the assumptions made. **(10 Marks)**

OR

2 a. Derive an expression for the temperature distribution through the plane wall with uniform thermal conductivity. **(06 Marks)**

b. A metal [K = 45 W/m°C] steam pipe of 5 cm inside diameter and 6.5 cm outside diameter is lagged with 2.75 cm thickness of high temperature high insulation having thermal conductivity 1.1 W/m°C. convective heat transfer coefficients on the inside and outside surfaces are 4650 W/m^2K and 11.5 W/m^2K respectively. If the steam temperature is 200°c and the ambient temperature is 25°C. Calculate:

i) Heat loss per metre length of pipe
ii) Temperature at the interfaces
iii) Overall heat transfer coefficient to inside and outside surfaces. **(10 Marks)**

Module-2

3 a. Derive an expression for critical thickness of insulation for a cylinder. **(06 Marks)**

b. The handle of a ladle used for pouring molten metal at 327°C is 30 cm long and is made of 2.5 cm × 1.5 cm mild steel bar stock [K = 43 W/mK]. In order to reduce grip temperature. it is proposed to make a hallow handle of mild steel plate 0.15 cm thick to the same rectangular shape. If the surface heat transfer coefficient is 14.5 W/m^2K and the ambient temperature is 27°C, estimate the reduction in the temperature of grip. Neglect the heat transfer from inner surface of the hallow shape. **(10 Marks)**

OR

4 a. What is lumped system analysis? Derive the temperature variation using lumped parameter analysis. **(06 Marks)**

b. An iron sphere of diameter 5 cm is initially at a uniform temperature of 225°C. It is suddenly exposed to an ambient at 25°C with convection coefficient of 500 W/m^2K.

i) Calculate the centre temperature 2 minute after the start of exposure.
ii) Calculate the temperature at a depth of 1 cm from the surface after 2 minute of exposure.
iii) Calculate the energy removed from the sphere during this period.

Take thermo physical properties of iron sphere K = 60 W/mK, ρ = 7850 kg/m^3. C = 460 J/kg, $\alpha = 1.6 \times 10^{-5}$ m^2/s. **(10 Marks)**

Module-3

5 a. Explain the three types of boundary conditions are applied in finite difference representations. **(06 Marks)**

b. Derive the relation between normal intensity and emissive power. **(10 Marks)**

OR

6 a. Explain:
i) Stefan Boltzman law
ii) Kirchoff's law
iii) Planks law **(06 Marks)**

b. Two large parallel plates with $\epsilon = 0.5$ each, are maintained at different temperatures and are exchanging heat only by radiation. Two equally large radiations shields with surface emissivity 0.05 are introduced in parallel to the plates. Find the percentage reduction in net radiative heat transfer. **(10 Marks)**

Module-4

7 a. Explain the physical significance of:
(i) Prandtl number (ii) Reynolds number (iii) Nusselt number **(06 Marks)**

b. Air at 1 atm pressure and temperature 25°C flowing with a velocity 50 m/s crosses an industrial heater made of long solid rod of diameter 20 mm. The surface temperature of the heater is 457°C. Determine the allowable electrical power density (W/m^3) within the heater per meter length. **(10 Marks)**

OR

8 a. A circular plate of 25 cm diameter with both surfaces maintained at a uniform temperature of 100°C is suspended horizontally in atmospheric air at 20°C. Determine the heat transfer from the plate. **(10 Marks)**

b. Obtain the fundamental relationship between Nusselt, Prandtle and Reynolds number using Buckingham's π - theorem for forced convection heat transfer. **(06 Marks)**

Module-5

9 a. Derive an expression for LMTD for a parallel flow heat exchanger. **(06 Marks)**

b. A refrigerator is designed to cool 250 kg/hr of hot fluid of specific heat 3350 J/kg°C at 120°C using a parallel arrangement 1000 kg/hr of cooling water is available for cooling purposes at a temperature of 10°C. If the overall heat transfer coefficient is 1160 $W/m^2°C$ and the surface area of the heat exchanger is 0.25 m^2. Calculate the outlet temperature of the cooled liquid and water and also the effectiveness of the heat exchanger and rate of heat transfer. **(10 Marks)**

OR

10 a. Sketch and explain boiling curve. **(06 Marks)**

b. The outer surface of a vertical tube 80 mm in outer diameter and 1m long is exposed to saturated steam at atmospheric pressure. The tube surface is maintained at 50°C by flow of water through the tube, What is the rate of heat transfer to coolant and what is the rate of condensation of steam? **(10 Marks)**

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CBCS SCHEME

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15ME64

Sixth Semester B.E. Degree Examination, June/July 2019
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. Use of design data handbook is permitted.
3. Assume suitably missing data.

Module-1

1 a. Differentiate between straight and curved beam. **(04 Marks)**

b. A closed ring is made up of 50mm diameter steel bar having allowable tensile stress of 200 MPa. The inner diameter of ring is 100mm. For the load of 30 kN, find the maximum stress in the bar and specify the location. If the ring is cut as shown part B of the Fig.Q1(b), check whether it is safe to support the applied load. **(12 Marks)**

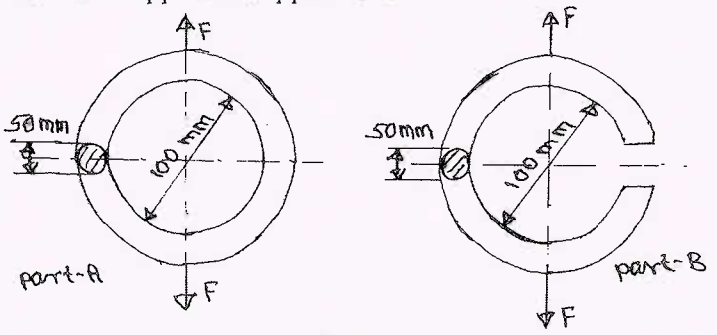

Fig.Q1(b)

OR

2 a. A high pressure cylinder consists of a steel tube with inner and outer diameter of 20 mm and 40mm respectively. It is jacketed by an outer steel tube with an outer diameter of 60mm. The tubes are assembled by shrinking process in such a way that maximum principal stress is limited to 100 MPa. Calculate the shrinkage pressure and original dimensions of the tube. Take E = 207 kN/mm^2. **(08 Marks)**

b. A cylinder of 200 mm diameter is covered with a cast iron plate and is fixed at circumference. Its thickness is 9mm and is subjected to a uniform force of 6 kN over a diameter of 100 mm. Find the stress induced in the plate and deflection under load. Take E = 120 kN/mm^2. **(08 Marks)**

Module-2

3 a. Sketch and explain Block and Tackle mechanism of wire rope. **(06 Marks)**

b. It is required to design a V-belt drive to connect a 7.5 kW, 1440 rpm induction motor to a fan, running at approximately 480 rpm, for a service of 24 hours per day. Space is available for a centre distance of about 1m. **(10 Marks)**

OR

4 a. For a Leaf spring prove that stress in full length leaves is 50% greater than that of graduated leaves. **(06 Marks)**

b. At the bottom of a mine shaft a group of 10 identical close coiled helical springs are set in parallel to absorb the shock caused by the falling of the cage in case of a failure. The loaded cage weighs 75 kN, while the counter weight has a weight of 15 kN. If the loaded cage falls through a height of 5m from rest, find the maximum stress induced in each spring if it is made of 50mm diameter steel rod. The spring index is 6 and the number of active turns in each spring is 20. Modulus of rigidity $G = 8\times10^4$ N/mm^2. **(10 Marks)**

Module-3

5 Design a pair of helical gears to transmit 15 KW at 1200 rpm of pinion. The gear is to rotate at 600 rpm. The helix angle is 17.5°. The centre distance between the gears is 150mm. The pinion is made of high carbon steel (σ_0 = 103.5 MPa) and gear of 0.40% carbon steel, untreated (σ_0 = 69.6 MPa). **(16 Marks)**

OR

6 a. Derive an expression for Beam strength of a spur gear tooth : (Lewis equation). **(06 Marks)**

b. The following parameters refers to a pair of right angle bevel gears:
Power to be transmitted = 8 kW
Speed of pinion = 1600 rpm
Pcd of pinion = 100 mm
Speed of gear = 400 rpm
Permissible static stress for both gear materials = 138 MPa
Calculate module face width of gears number of teeth on pinion and gear. **(10 Marks)**

Module-4

7 In a worm gear speed reducer, the speed reduction is 30:1. Design the worm gear drive from consideration of strength to connect two shafts which are 275mm apart and transmits 7.5 kW at a worm speed of 3000 rpm. The worm is made of hardened steel (σ_0 = 200 MPa) and worm wheel of phosphor bronze (σ_0 = 84 MPa). The teeth are 20° stub. **(16 Marks)**

OR

8 a. A multi disc clutch has three discs on the driving shaft and two on the driven shaft. The inside diameter of the contact surface is 120mm. The maximum pressure between the surface is limited to 0.1 N/mm^2, calculate outside diameter of contact surface for transmitting 25 kW at 1575 rpm. Assume uniform wear condition at coefficient of friction of 0.3. **(08 Marks)**

b. A differential band brake operates on a sheave of 420 mm diameter and rotates at 5 rev/sec. The brake has to absorb 21 kW. Coefficient of friction is 0.25. Determine the force 'F' required to set the brake for clockwise rotation, refer Fig.Q8(b). **(08 Marks)**

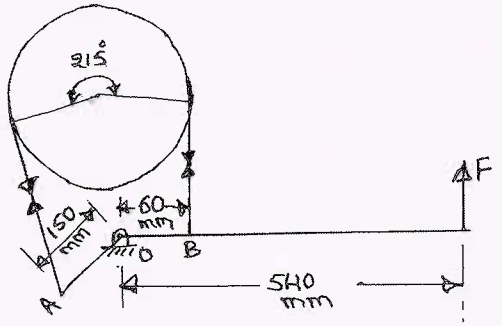

Fig.Q8(b)

Module-5

9 a. A 75 mm long full journal bearing of diameter 75mm supports a load of 10 kN. The speed of the journal is 1200 rpm. The absolute viscosity of the oil is 10×10^{-3} Pas and the diametral clearance ratio is 0.001. Determine the coefficient of friction by using
(i) Petroff's equation (ii) McKee's equation (iii) Raimondi and Boyd curve. **(08 Marks)**

b. A full journal bearing of 50mm diameter, 75 mm long supports a radial load of 1000 N. The speed of the shaft is 600 rpm. The surface temperature of bearing is limited to 60°C and the room temperature is 30°C. Determine the viscosity of the oil, if the bearing is well ventilated and no artificial cooling is to be used. The ratio of journal diameter to diametral clearance is 1000. **(08 Marks)**

OR

10 a. A ball bearing operates in the following work cycle.

Element	Radial load N	Speed rpm	Element time %
1	3000	720	30
2	7000	1440	40
3	5000	900	30

The dynamic load capacity of bearing is 16500 N. Calculate
(i) Average speed of rotation
(ii) Equivalent radial load
(iii) Bearing life. **(08 Marks)**

b. A single row deep groove ball bearing is subjected to a radial force of 8 kN and a thrust force of 3 kN. The values of X and Y are 0.56 and 1.5 respectively. The shaft rotates at 1200 rpm. The diameter of the shaft is 75mm and bearing number 6315 is selected for this application.
(i) Estimate the life of this bearing with 90% reliability.
(ii) Estimate the reliability for 20,000 hours life. **(08 Marks)**

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CBCS SCHEME

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15ME655

Sixth Semester B.E. Degree Examination, June/July 2019
Automobile Engineering

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. With the help of PV diagram, compare SI and CI engines. **(06 Marks)**
b. With help of neat sketch give construction details of connecting rod. **(05 Marks)**
c. With help of neat sketch, explain pre-chamber type of combustion chamber. **(05 Marks)**

OR

2 a. Why cooling is necessary and what are different methods of cooling? **(04 Marks)**
b. Classify valve operating mechanisms and with the help of diagram, explain overhead inlet and side exhaust valve mechanism. **(06 Marks)**
c. Explain dry sump lubrication system, with help of neat sketch. **(06 Marks)**

Module-2

3 a. With the help of neat sketch explain multi-plate clutch. **(08 Marks)**
b. Sketch and explain Hotch Kiss Drive and also compare with torque tube. **(08 Marks)**

OR

4 a. Explain working of master cylinder of a braking system with the help of neat sketch. **(10 Marks)**
b. What is ABS? Explain with appropriate sketch. **(06 Marks)**

Module-3

5 a. Define following: (i) Camber (ii) Caster (iii) King pin inclination **(06 Marks)**
b. With the help of sketch explain Mac person strut type sub pension. **(10 Marks)**

OR

6 a. What are the requirements of Ignition system? **(04 Marks)**
b. Sketch and explain Electronic Ignition system. **(08 Marks)**
c. Compare Battery and Magneto Ignition system. **(04 Marks)**

Module-4

7 a. What do you mean by supercharging? Explain any one method of super charging. **(06 Marks)**
b. Explain centrifugal type of super charger. **(06 Marks)**
c. What are limitations of turbo charging? **(04 Marks)**

OR

8 a. What are fuel mixture requirements for SI engine? **(04 Marks)**
b. Explain working of Zenith carburetor. **(08 Marks)**
c. What are CRD engine? Explain principle of working. **(04 Marks)**

Module-5

9 a. Mention various pollutants. List measures to be taken to reduce pollution. **(04 Marks)**

b. Discuss positive crank case ventilation system to control crank case emission. **(06 Marks)**

c. Discuss how evaporative emissions can be controlled. **(06 Marks)**

OR

10 a. Discuss about, how air injection system controls pollution. **(06 Marks)**

b. Write short notes on any two:

i) Catalytic converter

ii) Euro IV norms for petrol and diesel engines

iii) Redesign of combustion chamber to control emission. **(10 Marks)**

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CBCS SCHEME

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Sixth Semester B.E. Degree Examination, June/July 2019
Industrial Safety

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define Industrial safety in context with OHS. What are the issues and topics it covers pertaining to Industry. (08 Marks)

b. How do you categorize workplace hazards? Explain briefly with suitable examples. (08 Marks)

OR

2 a. In construction, explain the hazards related to scaffolding and fall. What are the measures to be taken for protection? (08 Marks)

b. What is Material Safety Data Sheet (MSDS)? Explain the different sections of MSDS. (08 Marks)

Module-2

3 a. What are the different classes of fire? Explain with examples. (08 Marks)

b. What is Fire Tetrahedron? Discuss various types of fire extinguishers and their applications. (08 Marks)

OR

4 a. List and explain common fire hazards and how they can be prevented. (08 Marks)

b. In case of fire accidents, what are the intervention methods and techniques to be adopted to control fire? (08 Marks)

Module-3

5 a. What precautions are needed to avoid accident in material handling? (08 Marks)

b. What is Risk Assessment, Analysis and Evolution? How do you implent in case of welding operations? (08 Marks)

OR

6 a. Explain the various mechanical hazards associated with machines. (08 Marks)

b. Discuss the various safety control measures, with respect to machines. (08 Marks)

Module-4

7 a. Define Electrical Safety. List the basic factors to be considered to ensure electrical safety in industries. (08 Marks)

b. What kind of injuries result from electrical current? Discuss briefly the preventive measures related to electrical hazards. (08 Marks)

OR

8 a. What safety precautions to be taken by electrical safety engineer and discuss the role and responsibility. (08 Marks)

b. List and explain various Personal protection equipment used in handling electrical equipments. (08 Marks)

Module-5

9 a. What is Chemical Safety? List and explain various chemical hazards. (08 Marks)

b. Discuss what are guidelines to be followed when working with chemicals. (08 Marks)

OR

10 a. Explain the methods in implement for labeling of chemicals. (08 Marks)

b. With a suitable case study, explain implementation of chemical safety in a CNG plant. (08 Marks)

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CBCS SCHEME

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15ME664

Sixth Semester B.E. Degree Examination, June/July 2019
Total Quality Management

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. List out six basic concepts of TQM and briefly explain them. **(09 Marks)**
b. With a diagram, explain TQM FrameWork. **(05 Marks)**
c. List out the benefits of implementing TQM. **(02 Marks)**

OR

2 a. Briefly describe the various benefits of ISO Registration. **(07 Marks)**
b. Explain the various requirements for ISO 9001 series. **(09 Marks)**

Module-2

3 a. Explain briefly the seven characteristics of effective people. **(07 Marks)**
b. List out Deming's 14 points of TQM philosophy and explain any three. **(09 Marks)**

OR

4 a. What is Quality Council? List out its duties. **(06 Marks)**
b. Explain seven steps for strategic planning. **(10 Marks)**

Module-3

5 a. Define the term internal customer and external customer. Give an example for each type. **(03 Marks)**
b. Explain Kano's model of customer satisfaction. **(08 Marks)**
c. Describe briefly the customer retention. **(05 Marks)**

OR

6 a. Define 'empowerment' and what are the three conditions to achieve empowerment? **(04 Marks)**
b. Explain Maslow's theory of motivation and relate this to any industry or organization. **(10 Marks)**
c. List out various advantages of employee involvement. **(02 Marks)**

Module-4

7 a. Explain PDSA cycle for continuous improvement. **(08 Marks)**
b. Explain: (i) Juran Trilogy (ii) Kaizen principles **(08 Marks)**

OR

8 a. Explain Pareto diagram, Scatter diagram and Cause-Effect diagram. **(09 Marks)**
b. What are control charts? Explain their importance, construction for TQM organization. **(07 Marks)**

Module-5

9 a. What is 'Bench-Marking'? Explain briefly the process of Benchmarking. **(08 Marks)**
b. Describe briefly the Environmental Management System Model. **(08 Marks)**

OR

10 a. What is QFD? Describe the various steps involved in QFD. **(08 Marks)**
b. Explain Failure Mode and Effect Analysis, Product liability. **(08 Marks)**

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CBCS SCHEME

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15ME62

Sixth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Computer Integrated Manufacturing

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define Automation. Explain the different types of automation in brief with suitable examples. **(10 Marks)**

b. Explain the following mathematical models :
(i) Manufacturing Lead Time
(ii) Production Rate
(iii) Availability **(06 Marks)**

OR

2 a. Enumerate the objectives of Automated flow lines. **(08 Marks)**

b. With a neat sketch explain Rotary configuration. **(08 Marks)**

Module-2

3 a. Explain in brief the major functions of Graphics package in mechanized environment. **(07 Marks)**

b. A square with an edge length of 10 units is located on the origin with one of the edge at an angle of 30° with positive x-axis. Calculate the new position of the square if it is rotated about z-axis by an angle 30° in clockwise direction. **(09 Marks)**

OR

4 a. With a neat sketch explain Retrieval CAPP system. **(08 Marks)**

b. Explain the structure of MRP system with the help of block diagram. **(08 Marks)**

Module-3

5 a. What are the benefits of Flexible Manufacturing System? **(08 Marks)**

b. List out the advantages of Group Technology. **(08 Marks)**

OR

6 a. Explain in brief the different types of AS/RS systems. **(06 Marks)**

b. The following data refers to the precedence relationship and element times for a New product.

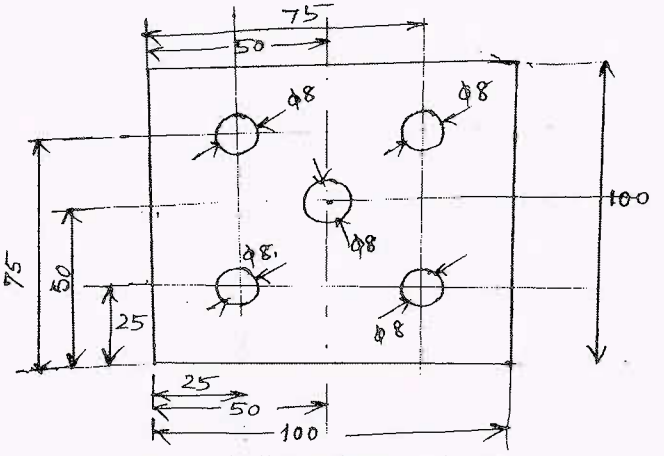
Element No.	1	2	3	4	5	6	7	8	9	10	11	12
T_e (min)	0.2	0.4	0.7	0.1	0.3	0.11	0.32	0.6	0.27	0.38	0.5	0.12
Precedence	-	-	1	1, 2	2	3	3	3, 4	6, 7, 8	5, 8	9, 10	11

Using Largest candidate rule method,
(i) Construct the precedence diagram.
(ii) If the ideal cycle time is 1.0 min find the number of work stations required.
(iii) Balance delay and Balancy efficiency. **(10 Marks)**

Module-4

7 a. With the help of block diagram explain the elements of CNC system and highlight its advantages. **(10 Marks)**

b. Write a part program for the following :
- figure (drawing) - Peck drilling operation – Take drill dia 8 mm. [Refer Fig.Q7(b)]



Note : All dimensions are in mm

Fig.Q7(b) **(06 Marks)**

OR

8 a. Define Industrial Robot. Explain the different configurations of a robot with neat sketches. **(10 Marks)**

b. Explain the following Terminology related to robot.
(i) Accuracy (ii) Resolution (iii) Repeatability. **(06 Marks)**

Module-5

9 a. What is additive manufacturing? Explain the different steps involved in preparing a component. **(08 Marks)**

b. Explain the different powder Bed Fusion technique developed. **(08 Marks)**

OR

10 a. Explain in brief the various components of Industry 4.0. **(10 Marks)**

b. Write a short note on Cloud computing. **(06 Marks)**

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CBCS SCHEME

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15ME63

Sixth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Heat Transfer

Time: 3 hrs. Max. Marks: 80

Note: 1. ***Answer FIVE full questions, choosing one full question from each module.***
2. Use of heat transfer data hand book and steam tables are permitted.

Module-1

1 a. Explain three modes of heat transfer with their basic laws. **(06 Marks)**

b. The inner wall of the furnace is made of fire brick of thickness 115 mm and the outer wall is made of red brick of thickness 230 mm. The temperature of the inside furnace is 685°C and the temperature of outside surface of red brick is 121°C under steady state condition to reduce the heat loss a layer of Magnesia insulation of thickness 50 mm is added on the outer surface of red brick after steady state condition is reached. The various temperature are measured as flame side of furnace 712°C junction between the fire brick and red brick is 655°C, junction between the red brick and Magnesia is 490°C outer surface Magnesia temperature is 77°C. Calculate the heat loss in first and second cases and find the percentage of heat loss reduction. Assume thermal conductivity of Magnesia is 0.085 W/m°C. **(10 Marks)**

OR

2 a. State the assumptions and derive general 3-dimensional heat conduction equation in Cartesian co-ordinates. **(08 Marks)**

b. A hollow sphere is made up of steel having thermal conductivity of 45 W/m°C. It is heated by means of a coil of resistance 100 Ω which carries a current of 5 amps. The coil is located inside a hallow space at the centre. The outer surface area of sphere is 0.2 m^2 and its mass 32 kg assuming density of the sphere material to be 8 gm/cc. Calculate the temperature difference between the inner and outer surface. **(08 Marks)**

Module-2

3 a. Derive an expression for the temperature distribution and heat flow for a pinfin, when the tip of the fin is insulated. **(08 Marks)**

b. A thin rod of copper K = 100 W/m°C, 12.5 mm in diameter spans between two parallel plates 150 mm apart. Air flows over the rod providing a heat transfer co-efficient of 50 W/m^2°C. The surface temperature of the plate exceeds the air by 40°C. Determine (i) The excess temperature at the centre of the rod over that of air and (ii) Heat lost from the rod in watts. **(08 Marks)**

OR

4 a. Show that the temperature distribution under lumped analysis is given by,

$$\frac{T - T_\infty}{T_i - T_\infty} = e^{-BiFo}$$

Where T_i = Initial temperature

T_∞ = Ambient temperature **(08 Marks)**

b. A 15 mm diameter mild steel sphere (K = 42 W/m°C) is exposed to coding air flow at 20°C resulting in the convective co-efficient h = 120 W/m^2°C. Determine the following:

(i) Time required to cool the sphere from 550°C to 90°C.
(ii) Instantaneous heat transfer rate for 2 mins after start of cooling.
(iii) Total energy transferred from the sphere during first 2 mins.

Take for mild steel S = 7850 kg/m^3, C_p = 475 J/kg°C, α = 0.045 m^2/hr **(08 Marks)**

Module-3

5 a. Explain three types of boundary conditions applied in Finite difference representations. **(09 Marks)**

b. Consider steady-state heat conduction in a square region of side 2b, in which energy is generated at a constant rate of g w/m^3. The boundary conditions for the problem are shown in Fig. Q5 (b). Write the finite difference equations for nodes 1, 3 and 5 in this Fig. Q5 (b) **(07 Marks)**

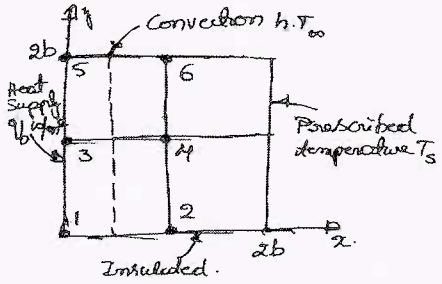

Fig. Q5 (b)

OR

6 a. State and explain : (i) Kirchoff's law (ii) Plank's law (iii) Wein's displacement law (iv) Lambert's cosine law. **(08 Marks)**

b. Two large parallel plots with emissivity 0.5 each are maintained at different temperatures and are exchanging heat only by radiation. Two equally large radiation shields with surface emissivity 0.05 are introduced in parallel to the plates. Find the percentage reduction in net radiative heat transfer. **(08 Marks)**

Module-4

7 a. With a diagram, explain velocity boundary layer and thermal boundary layer. **(08 Marks)**

b. Lubricating oil at a temperature of 60°C enters a 1 cm diameter tube with a velocity 3.5 m/s. The tube surface is maintained at 30°C. Calculate the tube length required to cool the oil to 45°C. Assume that the oil has the following average properties for the temperature range of this problem S = 865 kg/m^3, K = 0.14 W/m°K, C_P = 1.78 kJ/kgK and $\gamma = 9 \times 10^{-6}$ m^2/s. **(08 Marks)**

OR

8 a. Explain the significance of, (i) Reynold's number (ii) Prandtl number (iii) Nusselt number (iv) Stanton number. **(08 Marks)**

b. Calculate the convection heat loss from a radiator 0.5 m wide and 1 m high maintained at a temperature of 84°C in a room at 20°C. Treat the radiator as a vertical plate. **(08 Marks)**

Module-5

9 a. With assumptions, determine LMTD for counter flow heat exchanger. **(08 Marks)**

b. A parallel flow heat exchanger uses 1500 kg/hr of cold water entering at 25°C to cool 600 kg/hr of hot water entering at 70°C. The exit temperature on the hot side is required to be 50°C. Neglecting the effects of fouling make calculations for the area of heat exchanger. It may be assumed that the individual heat transform co-efficient on both sides are 1600 W/m^{2}K. Use LMTD and NTU approaches. **(08 Marks)**

OR

10 a. With a neat sketch, explain the different regimes of pool boiling. **(08 Marks)**

b. A vertical square plate 300m × 300m is exposed to steam at atmospheric pressure. The plate temperature is 98°C. Calculate the heat transfer and the mass of steam condensed per hour. **(08 Marks)**

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CBCS SCHEME

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15ME64

Sixth Semester B.E. Degree Examination, Dec.2018/Jan.2019
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. Use of hand book is permitted.

Module-1

1 a. List the assumptions made in obtaining stress equation in curved beam. **(06 Marks)**

b. Compute the combined stresses at the inner and outer fiber in the critical cross-section of a crane hook which is required to lift loads upto 25 kN. The hook has trapezoidal cross section with the parallel sides 60mm and 30mm. The distance between them being 90mm. The inner radius of hook is 100 mm. The load line is nearer to the inner surface of the hook by 25 mm than the centre of curvature at the critical section. What will be the stresses at inner and outer fiber, if the beam is treated as straight beam for given load? **(10 Marks)**

OR

2 a. A cast iron cylindrical pipe of outside diameter 300mm and inside diameter 200mm is subjected to an internal pressure of 20 MPa and external pressure of 5 MPa. Determine the tangential and radial stresses at inner, middle and outer surface. Also sketch the stresses distribution across the thickness. **(08 Marks)**

b. A 440 mm outer diameter, 250mm inner diameter and 300mm long steel hub is to be shrink on to a 250mm diameter steel shaft. If the torque is to be transmitted is 300 kNm and $\mu = 0.18$, determine the amount of interference required. **(08 Marks)**

Module-2

3 a. A belt is required to transmit 18.5 kW from a pulley of 1.2m diameter running at 250 rpm to another pulley which run at 500 rpm. The distance between the centres of pulley is 2.7m. The following data refers to open belt drive $\mu = 0.25$. Safe working stress for leather is 1.75 MPa. Thickness of belt 10 mm. Determine the width and length of belt taking centrifugal tension into account. Also find the initial tension in belt and speed at which this can be transmitted. **(08 Marks)**

b. A V-belt is to transmit 20 kW from a 250 mm pitch diameter operating at 1500 rpm to a 900 mm diameter flat pulley. The centre distance between input and output shaft 1 m. The groove angle is 40° and $\mu = 0.2$ for both pulleys and shears combination. The cross section of belt is 38mm wide at the top and 19mm at bottom by 25mm deep. Each belt weighs 11 kN/m^3 and allowable tension per belt is 1000 N. How many belts are required? **(08 Marks)**

OR

4 a. A loaded narrow gauge car weighs 18 kN and moving at a velocity of 80 m/min is brought to rest by a buffer spring of two helical springs. In bringing the car to rest the spring undergoes a compression of 200mm. The allowable shear stress is 0.3 GPa and spring index is 8. Solve for the dimensions of spring. Take G = 84 GPa. **(08 Marks)**

b. A semi-elliptical leaf spring is used for the suspension of the rear axle of a truck. It consists of 2 extra full length leaves and IS graduated leaves with a band of 100 mm. The centre to centre distance between spring eyes is 1.1 m. All leaves are pre-stressed to 400 MPa. E = 200 GPa. The max. force on spring is 75 kN. Take total depth to width ratio as 2. Determine (i) Cross section of leaf (ii) Initial nip (iii) Load on band. **(08 Marks)**

Module-3

5 Design a pair of spur gear 20° involute to transmit 30 kW of power at 600 rpm of pinion. Number on teeth on pinion is 15, transmission ratio is 5:1. Material of the pinion is cast steel (σ = 137.34 MPa) and that of gear is high grade cast iron (σ = 103 MPa.). **(16 Marks)**

OR

6 a. Derive an equation for formative number of teeth on bevel gear. **(06 Marks)**

b. Determine the module for a pair of helical gear to transmit 15 kW of power at 4000 rpm of pinion with i = 5:1. Pinion is made of 0.4% carbon steel untreated (σ = 69.6 MPa) and gear is made of cast iron (σ = 31 MPa). Helix angle is 20°. Number of gear teeth on. Pinion is 24. (Gear system 20° FDI). **(10 Marks)**

Module-4

7 Design worm drive to transmit a power of 2 kW at 1000 rpm, i = 20:1 and centre distance is 200 mm. **(16 Marks)**

OR

8 a. Design a multi-plate clutch to transmit 25 kW at 300 rpm. The plates have friction surfaces of steel and phosphorous bronze run on oil. Design clutch for 25% over load. **(08 Marks)**

b. A simple band brake is required to transmit a torque of 100 kg-m. The brake drum diameter is 400 mm, μ = 0.25. Find the effort required to obtain braking in clock-wise direction. Design the band and the lever. Take θ = 270°. [Refer Fig.Q8(b)] **(08 Marks)**

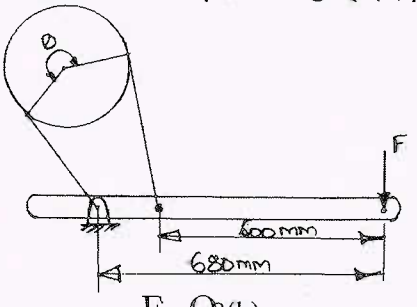

Fig.Q8(b)

Module-5

9 a. Derive Petroff's equation for lightly loaded bearing. **(06 Marks)**

b. A lightly loaded journal bearing has a load of 1 kN. The oil used is SAE60 and mean effective temperature of operation is 40°C. The journal has a diameter of 50 mm and the bearing has a diameter of 50.5mm. The speed of journal is 15000 rpm. The L/d ratio is limited to 1.2. Determine CoF and power loss in friction. **(10 Marks)**

OR

10 a. Explain the principle of Hydro Dynamic lubrication. **(06 Marks)**

b. A spindle of a wood-working machine runs at 1000 rpm. It is mounted on two single-row ball bearings. One of which is required to carry radial load of 2250 N and thrust load of 1900 N. The machine runs 8 hrs/day. Assuming a life of 4 years a spindle diameter equal to 30 mm. Select a suitable bearing. **(10 Marks)**

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15ME664

Sixth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Total Quality Management

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define TQM. Explain six basic concepts of TQM. **(08 Marks)**

b. List and explain dimensions of Quality. **(08 Marks)**

OR

2 a. Explain the contributions of Quality Gurus. **(06 Marks)**

b. Sketch the TQM Frame work. **(04 Marks)**

c. Write short note on Benefits of ISO Registration. **(06 Marks)**

Module-2

3 a. Explain the characteristics of Quality Leaders. **(08 Marks)**

b. Define Ethics. List any six leadership concepts. **(08 Marks)**

OR

4 List Deming's 14 points and explain any one. **(16 Marks)**

Module-3

5 a. With a neat sketch, explain Kano – Model. **(08 Marks)**

b. State and explain Elements of customers service. **(08 Marks)**

OR

6 a. Explain Maslow's hierarchy of needs. **(08 Marks)**

b. Define : Motivation , Performance , Reward , Recognition , Empowerment , Gainsharing , Teams , Union. **(08 Marks)**

Module-4

7 a. Write short note on Six – Sigma. **(08 Marks)**

b. Explain i) PDSA cycle with continuous process improvement ii) KAIZEN. **(08 Marks)**

OR

8 a. Explain Control charts for variables and attributes. **(08 Marks)**

b. Explain : i) Pareto diagram ii) Cause and effect diagram. **(08 Marks)**

Module-5

9 a. With a neat sketch, explain Benchmarking Concept. **(08 Marks)**

b. Define QFD. With a neat sketch, explain 4 phases of QFD process. **(08 Marks)**

OR

10 a. Sketch the concept of Quality by Design and list the benefits of Quality by design. **(08 Marks)**

b. Define FMEA. List the stages of FMEA. **(08 Marks)**

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