CBCS SCHEME

USN | | | | | | | | | | |

15ME51

Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020
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 "Compounding Interest Factor" tables are permitted.

Module-1

1 a. Define management and explain the levels of management. **(08 Marks)**

b. List and explain the various functions of management. **(08 Marks)**

OR

2 a. Explain the importance of planning. **(08 Marks)**

b. Explain the various steps in decision making process, with a block diagram. **(08 Marks)**

Module-2

3 a. Briefly explain the principles of organization. **(08 Marks)**

b. Explain techniques of selection in detail. **(08 Marks)**

OR

4 a. How does Maslow's hierarchy of needs help a manager to motivate his subordinates? Explain. **(08 Marks)**

b. Discuss the steps involved in a control process. **(08 Marks)**

Module-3

5 a. With neat sketch explain problem solving process. How are the decisions taken? **(08 Marks)**

b. Find the effective rate of interest for an actual rate of interest of 10% when compounded i) Yearly ii) Biannually iii) Monthly iv) Daily. **(08 Marks)**

OR

6 a. Explain how to demand, how of supply and equilibrium point with suitable example. **(08 Marks)**

b. Sketch and explain cash flow diagram for borrower's and lender's point of view. **(08 Marks)**

Module-4

7 a. List and explain the conditions for present worth comparisons. **(08 Marks)**

b. Two bikes of brand 'P' and 'Q' are available on the following terms:

i) Bike 'P' → Make a down payment of Rs.5000 and then Rs.6000 at the end of each year for 7 years.

ii) Bike 'Q' → Make a downpayment 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 next 4 years.

Select the better brand based on the future worth method of comparison. If rate of interest is 10% compounded annually. **(08 Marks)**

OR

8 a. Define the following terms:
i) Ownership life
ii) Accounting life
iii) Economic life. **(06 Marks)**

b. A farm house can be purchased for Rs.90,000 and the expected resale value after 20 years is Rs.63,000. If the annual rental income is Rs.11,800 and expenses Rs.4,700 what will be the rate of returned earned on this farm house? **(10 Marks)**

Module-5

9 a. List and explain the basic methods of depreciation. **(08 Marks)**

b. List and briefly explain different elements of cost required for finding selling price of the product. **(08 Marks)**

OR

10 a. Briefly explain methods of costing. **(10 Marks)**

b. A C.I. stepped bar is shown in Fig.Q.10(b). Taking density of CI as 7.0208 gm/cc. Calculate unit of component. Also what is the cost of material if cost per kg is Rs.100? **(06 Marks)**

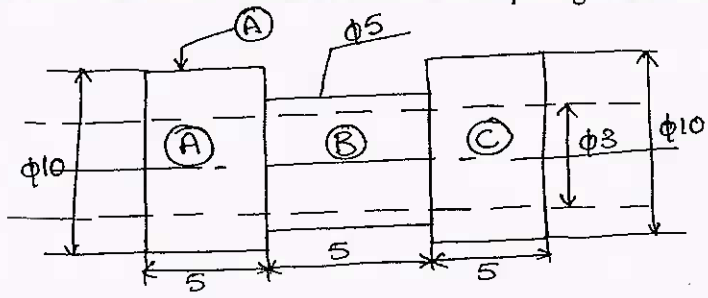


Fig.Q.10(b)

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

15ME52

Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Dynamics of Machines

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Considering slider crank mechanism, state and explain principle of virtual work. **(06 Marks)**

b. A four bar mechanism shown in Fig.Q1(b) is acted by a force P = 100. ∠120°N on link CD. The dimensions of the various links are AB = 40 mm, BC = 60 mm, CD = 50 mm, DA = 30 mm and DE = 20 mm. Determine the magnitude and direction of input torque T_2 on link AB for the static equilibrium of the mechanism.

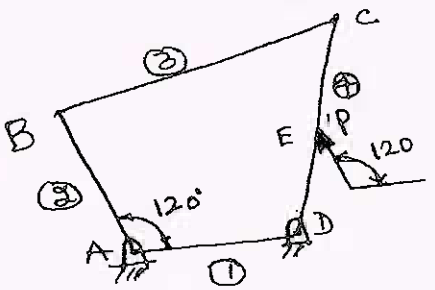


Fig.Q1(b) **(10 Marks)**

OR

2 a. Explain in brief D'Alembert's principle and state why it is used. **(06 Marks)**

b. A horizontal gas engine running at 240 rpm has a bore of 500 mm and stroke of 600 mm. The length of connecting rod is 1.2 m and mass of reciprocating parts is 200 kg. The difference between driving and back pressure is 0.4 N/mm^2, when the crank has turned an angle of 60° from inner dead center. Neglecting the affect 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 movement on the crank shaft
(vii) Acceleration of the flywheel which has mass of 100 kg and radius of gyration of 500 mm, while the power of the engine is 100 KW. **(10 Marks)**

Module-2

3 A rotor has the following properties.

Mass	Magnitude (kg)	Radius (mm)	Angle (degrees)	Axial distances from 1st mass (mm)
1	9 kg	100 mm	0°	-
2	7 kg	120 mm	60°	160 mm
3	8 kg	140 mm	135°	320 mm
4	6 kg	120 mm	270°	560 mm

If the shaft is balanced by two counter masses located at 100 mm radius r and revolving in planes midway of planes 1 and 2 and midway of 3 and 4, determine the magnitude of the masses and their respective angular position. **(16 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 balance, find the reciprocating mass and the relative angular position for each of the inner cranks. If the length of each crank is 300 mm, the length of each connecting rod is 1.2 m and the speed of rotation is 240 rpm, find maximum secondary unbalanced force. **(16 Marks)**

Module-3

5 a. Define the term stability and sensitivity of a governor. **(06 Marks)**

b. In an engine governor of the porter type, the upper and lower arms are 200 mm and 250 mm respectively and pivoted on the axis of rotation. The mass of the center load is 15 kg, the mass of each ball is 2 kg and friction of sleeve together with a resistance of the operating gear is equal to a load of 25 N at the sleeve. If the limiting inclination of the upper arms to the vertical are 30° and 40°, find taking friction into account, range of speed of the governor. **(10 Marks)**

OR

6 a. With neat sketches, explain the affect of gyroscopic couple on steering, pitching and rolling of a ship. **(08 Marks)**

b. An aeroplane flying at a speed of 300 kmph takes right turn with a radius of 50 meter. The mass of engine and propeller is 500 kg and radius of gyration is 400 mm. If the engine runs at 1800 rpm in clockwise direction, when viewed from tail end, determine the gyroscopic couple and state its effect on the aeroplane. What will be the effect, if the aeroplane turns to left instead of right? **(08 Marks)**

Module-4

7 a. Define the following terms:

(i) Harmonic motion (ii) Natural frequency

(iii) Amplitude (iv) Damping **(08 Marks)**

b. Add the following harmonic motions and check the solution graphically:

$x_1 = 2\cos(\omega t + 0.5)$ $x_2 = 5\sin(\omega t + 1.0)$ **(08 Marks)**

OR

8 a. Find the natural frequency of spring-mass system considering inertia effect of the mass of the spring. **(08 Marks)**

b. Find the natural frequency of the Fig.Q8(b).

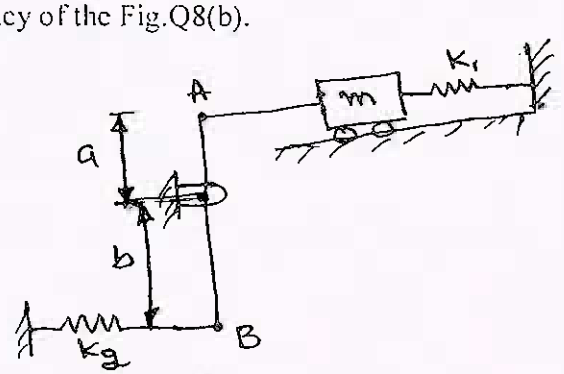


Fig.Q8(b) **(08 Marks)**

Module-5

9 a. Define logarithmic decrement and prove that logarithmic decrement $'\delta' = \frac{2\pi\xi}{\sqrt{1-\xi^2}}$ where ξ is damping ratio. **(07 Marks)**

b. The measurement on a mechanical vibrating system shows that the mass of 10 kg and that the springs can be combined to give an equal spring stiffness 5 N/mm. If the vibrating system have a dashpot attached which exerts a force of 40 N. when the mass have a unit velocity of 1 m/sec. Determine:

(i) Critical damping coefficient
(ii) Damping factor
(iii) Logarithmic decrement
(iv) Ratio of any consecutive amplitudes. **(09 Marks)**

OR

10 a. Write short notes on the following:

(i) Magnification factor
(ii) Transmissibility. **(06 Marks)**

b. A single cylinder vertical diesel engine has a total mass of 100 kg is mounted on a steel chassis frame. The static deflection owing to the weight of the chassis is 3 mm. The reciprocating masses of the engine amounts to 10 kg and the stroke of the engine 80 mm. A dashpot with a damping coefficient of 2 N/mm/sec is used to dampen the vibration. Determine:

(i) amplitude of the vibration, if the driving shaft rotates at 1000 rpm,
(ii) speed of the driving shaft, when resonance occurs. **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | 15ME53

Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020
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. Enumerate the difference between positive displacement machine and turbo machine. **(04 Marks)**

b. Define static and stagnation states. **(04 Marks)**

c. Air flows through an air turbine where its stagnation pressure is reduced in the ratio 5:1. The total to total efficiency is 80%. The air flow is 5 kg/s. If the total power output is 500 KW. Find:
(i) Inlet total temperature
(ii) Actual exit total temperature
(iii) Actual exit static temperature if the velocity is 100 m/s
(iv) Total to static efficiency **(08 Marks)**

OR

2 a. Show that for a turbine polytropic efficiency is given by

$$\eta_p = \left(\frac{n-1}{n}\right)\left(\frac{\gamma}{\gamma-1}\right)$$

where n is index of polytropic process, γ is ratio of specific heats. **(08 Marks)**

b. A turbine is to operate under a head of 25m at 200 rpm. The discharge is 9 m^3/s. If the efficiency is 90%, determine the performance of the turbine under a head of 20 m. **(08 Marks)**

Module-2

3 a. Show that the alternate form of Euler's turbine equation can be expressed as follows

$$W = \frac{(v_1^2 - v_2^2) + (u_1^2 - u_2^2) + (v_{r_2}^2 - v_{r_1}^2)}{2}$$

Draw the relevant velocity triangles. **(08 Marks)**

b. Show that for maximum utilization factor of an axial flow machine with $R = \frac{1}{4}$. The speed ration $\phi = \frac{2}{3}\cos\alpha$. where R is degree of reaction and α_1 is nozzle angle with respect to tangential direction at inlet. **(08 Marks)**

OR

4 a. A radial outward flow turbo machine has no whirl at inlet. The blade speed at exit is twice that at inlet. The radial velocity remains constant. Inlet blade angle is 45°. Show that the degree of reaction for this machine is given by $R = \frac{2 + \cot\beta_2}{4}$ where R is degree of reaction and β_2 is blade angle at exit. **(08 Marks)**

b. A single stage air blower with no inlet guide vanes is running at 3600 rpm. The mean diameter of rotor is 16 cm and mass flow rate of air through the blower is 0.45 kg/s. In the rotor the air is turned through an angle of 20° towards the axial direction during the passage through the rotor at mean diameter. Assume that the axial component of fluid velocity remain constant. Determine the power input and degree of reaction. Assume that the density of air is constant at 1.185 kg/m^3 and area of flow is 0.02 m^2. **(08 Marks)**

Module-3

5 a. What is need for compounding in stream turbines? Explain velocity compounding. **(04 Marks)**

b. For a 50% reaction turbine show that $\alpha_1 = \beta_2$ and $\alpha_2 = \beta_1$ where α_1 and α_2 are inlet and outlet angles of fixed blades and β_1 and β_2 are inlet and outlet angles of moving blades. **(04 Marks)**

c. In a single stage impulse turbine the nozzle angle is 25°. The absolute velocity of stream at exit is 300 m/s in a direction 120° to the direction of motion of blades assuming no axial thrust. Determine: (i) the blade angles and (ii) power developed. **(08 Marks)**

OR

6 a. Show that the maximum utilization factor of blade efficiency with equiangular blades is given by $\eta_{h\max} = \cos^2 \alpha_1$ where α_1 is the nozzle angle. **(08 Marks)**

b. The following data refers to a stage of a reaction turbine. Rotor diameter 1.5 m, speed ratio 0.72, outer blade angle 20° rotor speed 3000 rpm. Determine:
(i) Diagram efficiency
(ii) Percentage increase in diagram efficiency and rotor speed. If the rotor is designed to run at the best theoretical speed. Assume symmetric velocity triangles. **(08 Marks)**

Module-4

7 a. Show that the maximum hydraulic efficiency of pelton wheel turbine is given by

$$\eta_{h\max} = \frac{1 + K\cos\beta_2}{2}$$

where K is blade velocity coefficient, β_2 is blade discharge angle. **(08 Marks)**

b. The following data refers to a Francis turbine:
Net head = 60 m, speed = 700 rpm, shaft power = 294.3 KW, overall efficiency = 84%, hydraulic efficiency = 93%, flow ratio = 0.20, breadth ratio = 0.1, outer diameter of runner equal twice the inner diameter. The thickness of the vane occupy 5% of circumferential area of the runner, velocity of flow is constant at inlet and outlet and the discharge is radial at outlet. Determine :
(i) Guide blade angle
(ii) Runner vane angle at inlet and outlet
(iii) Diameter of runner at inlet and outlet
(iv) Width of the wheel at inlet **(08 Marks)**

OR

8 a. Explain with neat sketch working of Francis turbine. Mention the functions of draft tube. **(08 Marks)**

b. A pelton wheel is to be designed for a head of 60 m when running at 200 rpm. The pelton wheel develops 95.65 KW shaft power. The velocity of buckets = 0.45 times the velocity of jet, overall efficiency = 0.85 and coefficient of velocity = 0.98. Find:
(i) The diameter of jet
(ii) Diameter of wheel
(iii) Size of buckets
(iv) Number of buckets **(08 Marks)**

Module-5

9 a. When the pumps are arranged in series and in parallel? Explain any one arrangement. **(04 Marks)**

b. Explain the phenomenon of surging in centrifugal compressors. **(04 Marks)**

c. An air compressor has eight stages of equal pressure ratio 1.35. the flow rate through the compressor and its overall efficiency are 50 kg/s and 82% respectively. If the conditions of air at entry are 1.0 bar and 40°C. Determine:

(i) State of air at exit of compressor
(ii) Polytropic efficiency
(iii) Efficiency of each stage
(iv) Power required to drive the compressor, assume overall efficiency of drive as 90%. **(08 Marks)**

OR

10 a. Define slip and slip coefficient with respect to centrifugal compressor. **(02 Marks)**

b. Draw the velocity diagrams at exit of a centrifugal pump for forward, radial and backward curved vanes. **(06 Marks)**

c. A centrifugal pump impeller has radial vanes from inner radius of 8 cm to outer radius of 24 cm. The width of the impeller is constant and is 6 cm between the shrouds. If the speed of the pump is 1500 rpm and discharge is 250 lit/s. Find:

(i) Change in enthalpy
(ii) The outlet pressure if the inlet pressure is 0.8 kPa and water flow is outward. **(08 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

15ME54

Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Design of Machine Elements – I

Time: 3 hrs. Max. Marks: 80

Note: 1. *Answer FIVE full questions, choosing ONE full question from each module.*
2. *Use of design data handbook is permitted.*
3. *Missing data if any may be assumed.*

Module-1

1 a. What is mechanical engineering design? List the steps involved in design with a block diagram. **(04 Marks)**

b. A 50 mm diameter steel rod supports a load of 9 kN and in addition is subjected to a torsional moment of 100 N-m as shown in Fig. Q1 (b). Determine the maximum tensile and the maximum shear stress. **(08 Marks)**

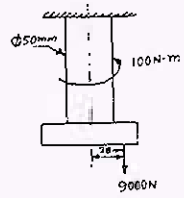


Fig. Q1 (b)

c. Explain the reasons for stress concentration in machine members and two methods adopted to reduce the same. **(04 Marks)**

OR

2 a. A machine element in the form of a Cantilever beam has a rectangular cross section of depth 200 mm. The beam is subjected to an axial tensile load of 60 KN and a transverse load of 50 KN acting downwards at the free end of the beam which has a span of 800 mm. Determine the width of rectangular cross section if the material of the beam is steel with an allowable tensile stress of 90 N/mm^2. (90 MPa) **(08 Marks)**

b. Determine the safe load that can be carried by a bar of rectangular cross section shown in Fig. Q2 (b) limiting the maximum normal stress to 130 MPa taking stress concentration into account. **(08 Marks)**

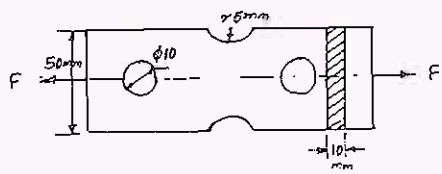


Fig. Q2 (b)

Module-2

3 a. Derive an expression for impact stress in an axial bar of cross section 'A' and length 'l' due to an impact load 'W' falling from a height 'h' on the bar. **(06 Marks)**

b. A Cantilever beam of rectangular cross section has a span of 800 mm. The rectangular cross section of the beam has a depth of 200 mm. The free end of the beam is subjected to a transverse load that fluctuates between 8 KN down to 5 KN up. The material for the beam is steel with an yield stress of 294 MPa, endurance strength of 275 MPa and factor of safety is 2.50. Determine the width of rectangular cross section taking surface finish factor as 0.95, size factor on 0.90 and stress concentration factor as 1.65. **(10 Marks)**

OR

4 a. Derive the Soderberg's equation for designing the members subjected to fatigue loading. **(06 Marks)**

b. A simply supported beam of span 1000 mm is subjected to a central load of 20 KN that falls from a height of 20 mm. The beam has a rectangular cross section of width 60 mm and depth 200 mm. The material of the beam has a modulus of elasticity of 207 GPa. Determine (i) Impact factor (ii) Instantaneous deflection (iii) Impact load. **(10 Marks)**

Module-3

5 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 $\sigma_t = 80$ N/mm^2, $\tau = 60$ N/mm^2, $\sigma_c = 150$ 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 4300 N-m. The permissible shear stress for bolt material is 50 MPa and permissible shear stress for flange is 8 MPa. Design bolts and the coupling. **(08 Marks)**

OR

6 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 gear of 200 mm diameter located 700 mm from the left bearing to another gear in front of it. The shaft rotates counterclockwise when viewed through the left bearing. The belt has a ratio of tensions of 2.5 and the gear is of 20° pressure angle. Determine the shaft diameter assuming the shaft to be made of steel with an yield shear stress of 180 MPa and factor of safety as 3. Take K_b = 1.5, K_t = 1.0 . **(16 Marks)**

Module-4

7 a. Design a double riveted butt joint with equal width cover plates to join two plates of thickness 10 mm. The allowable stress for plate and rivets are $\sigma_t = 80$ MPa, $\tau = 60$ MPa and $\sigma_c = 120$MPa . **(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. **(08 Marks)**

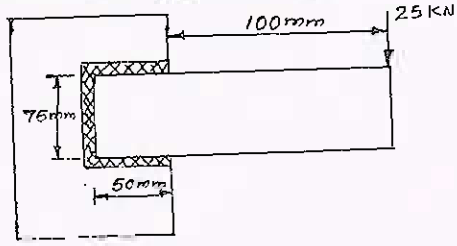


Fig. Q7 (b)

OR

8 a. Two lengths of a flat tie bar of 18 mm thick are connected by a butt joint with equal cover plates on either side. If a load of 400 KN is acting on the bar, design the joint such that the section of the bar is not weakened by more than one rivet hole. The working stresses for the material of the bar is 100 MPa in tension, for the material of the rivet 70 MPa in shear and 160 MPa in crushing. **(10 Marks)**

b. A plate of 80 mm wide and 15 mm thick is to be joined with another plate by a single transverse weld and a double parallel weld. Determine length of parallel weld if joint is subjected to static loading. Take $\sigma_t = 90$ MPa, $\tau = 55$ MPa an allowable stresses and stress concentration factor as 1.5 for transverse weld and 2.7 for parallel weld. **(06 Marks)**

Module-5

9 a. A cylinder head of a steam engine is subjected to a steam pressure of 0.8 MPa. It is held in position by means of 12 bolts. A soft copper gasket is used to make the joint leak proof. The bore diameter of the cylinder is 250 mm. Find the size of bolts so that the stress in bolts is not to exceed 110 MPa. **(08 Marks)**

b. The lead screw of a lathe has single start ISO trapezoidal threads of 30 mm outside diameter and 6 mm pitch. It drives a tool carriage and exerts an axial load of 1.5 KN on a thrust collar of 30 mm inside diameter and 50 mm outside diameter. If the lead screw rotates at 40 rpm, find the power required to drive the screw. Take coefficient of friction for power screw as 0.14 and for collar as 0.09. **(08 Marks)**

OR

10 a. Explain the stresses induced in a screw fastening subjected to static and impact loading. **(06 Marks)**

b. A power screw for a Jack has square threads of proportion $50 \times 42 \times 8$. The coefficient of friction at the threads is 0.1 and at the collar is 0.12. Determine the weight that can be lifted by this jack through a human effort of 400 N, through a hand lever of span 400 mm. **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

15ME554

Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Non Traditional Machining

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain non-traditional machining, by defining it and discuss about the need of non-traditional machining in detail. **(08 Marks)**

b. Discuss the comparison between traditional and non-traditional machining in detail. Classify the general NTM processes in detail. **(08 Marks)**

OR

2 a. Analyze the classification of non-traditional machining based on nature of energy employed in machining. **(10 Marks)**

b. Explain the specific advantages, limitations and applications of non-traditional machining. **(06 Marks)**

Module-2

3 a. Explain construction and working process of USM (Ultrasonic Machining) in detail by drawing a neat figure. Discuss the effect of amplitude and frequency and grain diameter. **(10 Marks)**

b. Describe application and limitations of USM. **(06 Marks)**

OR

4 a. Explain AJM (Abrasive Jet Machining) by drawing a neat schematic diagram. Describe "SOD" (Stand-Off Distance) and MRR (Material Removal Rate). **(08 Marks)**

b. Discuss WJM (Water Jet Machining) process in detail by drawing a neat schematic diagram. Describe Application, Advantages and Limitations. **(08 Marks)**

Module-3

5 a. Explain in detail for the ECM (Electro Chemical Machining). The element of ECM processes D.C. power and control system by drawing the adequate figures. **(08 Marks)**

b. Describe the chemistry of the ECM process and MRR by drawing a neat figure. **(08 Marks)**

OR

6 a. Discuss in CHM (Chemical Machining) the RESISTS (MASKANTS), Chemical Balance. **(08 Marks)**

b. Discuss about the Etchants, Applications and Advantages of CHM. **(08 Marks)**

Module-4

7 a. Explain EDM (Electrical Discharge Machining) principle, by drawing a neat figure and discuss in detail about DIELECTRIC FLUID. **(08 Marks)**

b. Discuss in detail about Pressure Flushing in EDM. Describe the Applications and Advantages of EDM. Explain Travelling Wire EDM. **(08 Marks)**

OR

8 a. Explain PAM (Plasma ARC Machining) in detail by drawing neat sketch. **(08 Marks)**

b. Discuss the safety precautions, application, advantages and limitations of PAM. **(08 Marks)**

Module-5

9 a. Explain in LBM (Laser Beam Machining) the Ruby Laser by drawing energy level diagram. **(08 Marks)**

b. Explain types of laser and discuss in detail the laser beam cutting with gas by drawing a neat figure. List out the advantages and applications. **(08 Marks)**

OR

10 a. Discuss the principle of EBM (Electron Beam Machining) by drawing a neat figure. **(08 Marks)**

b. Draw a graph of MRR (Material Removal Rate) by assuming 15% efficiency and explain advantages and limitations of EBM. **(08 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

15ME564

Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Project Management

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. What is a project? Explain the characteristics of project. **(08 Marks)**

b. Explain the steps of strategic planning process in details with the help of a flow diagram. **(08 Marks)**

OR

2 a. Explain briefly, the methods of selecting projects. **(08 Marks)**

b. What are the roles and responsibilities of project manager? Explain them briefly. **(08 Marks)**

Module-2

3 a. Explain the important key elements for defining the projects scope. **(06 Marks)**

b. Explain the different levels of hardware oriented work break down structure with a flow chart of suitable example. **(10 Marks)**

OR

4 a. What are the purposes of project schedule? **(05 Marks)**

b. Explain how the project schedules are limited and created. **(05 Marks)**

c. Explain briefly the importance of identifying the critical path in developing project schedule. **(06 Marks)**

Module-3

5 a. List the behavioural issues involved in completing project resourcing tasks. **(06 Marks)**

b. What are the important points to be considered when estimating resource needs? **(05 Marks)**

c. Write a short note on cost plant and cost estimating. **(05 Marks)**

OR

6 a. Define quality management plan and list the project quality tools. **(06 Marks)**

b. Explain the reasons for conducting project kick off meetings. **(05 Marks)**

c. What all should be verified before a baseline is created with Microsoft project software. **(05 Marks)**

Module-4

7 a. Explain supply chain management including components, factors and SCM decisions. **(10 Marks)**

b. Explain briefly different types of contracts. **(06 Marks)**

OR

8 a. Describe the different cases of early project termination. **(06 Marks)**

b. Write the simple project costomer feedback form. **(05 Marks)**

c. Briefly explain internal project issues. **(05 Marks)**

Module-5

9 a. Explain network construction rules. **(06 Marks)**

b. A project has the following time schedule :

Activity	Time in months	Activity	Time in months
1 – 2	2	4 – 6	3
1 – 3	2	5 – 8	1
1 – 4	1	6 – 9	5
2 – 5	4	7 – 8	4
3 – 6	8	8 – 9	3
3 – 7	5		

Construct PERT network and compute (i) Total float for each activity (ii) Critical path and its duration. **(10 Marks)**

OR

10 a. A project has the following characteristics

Activity	Most optimistic time (a)	Most pessimistic time (b)	Most likely time (m)
1 – 2	1	5	1.5
2 – 3	1	3	2
2 – 4	1	5	3
3 – 5	3	5	4
4 – 5	2	4	3
4 – 6	3	7	5
5 – 7	4	6	5
6 – 7	6	8	7
7 – 8	2	6	4
7 – 9	5	8	6
8 – 10	1	3	2
9 – 10	3	7	5

Construct a PERT network. Find critical path and variance for each event. **(10 Marks)**

b. Explain briefly a Fulkerson's rule. **(06 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

15ME61

Sixth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Finite Element Method

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. List the type of elements with neat sketch. **(06 Marks)**

b. A simply supported beam subjected to point load at the centre. Derive an equation for maximum deflection using trigonometrically function by RR method. **(10 Marks)**

OR

2 a. List the advantages and disadvantages of FEM. **(03 Marks)**

b. Explain Elasticity matrix [D] for stress and plain strain. **(04 Marks)**

c. Explain simplex, complex and multiplex elements. **(09 Marks)**

Module-2

3 a. Derive the shape function, in natural coordinate system for:

(i) Constant strain triangle.

(ii) 1D bar element. **(08 Marks)**

b. Using two point Gaussian quadrature formula evaluate and compare with exact solution:

(i) $I = \int_{-1}^{+1} \left(1 + \xi + 2\xi^2 + 3\xi^3\right) d\xi$

(ii) $I = \int_{-2}^{+2} (4 - y)^2 dy$ **(08 Marks)**

OR

4 a. For the stepped bar shown in Fig. Q4 (a), determine the nodal displacement, element stresses and reaction at supports.

$E_1 = 70$ GPa; $E_2 = 200$ GPa; $P = 200$ KN; $A_1 = 2400$ mm^2; $A_2 = 600$ mm^2 **(08 Marks)**

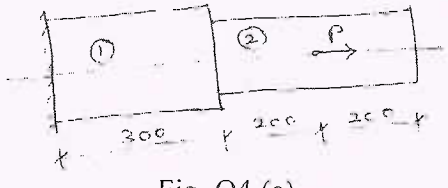


Fig. Q4 (a)

b. A plane truss shown in Fig. Q4 (b), determine nodal displacements, stresses in each element and reaction at supports.

$E = 200$ GPa ; $A_1 = 1200$ mm^2; $A_2 = 1000$ mm^2; $P = 50$ KN **(08 Marks)**

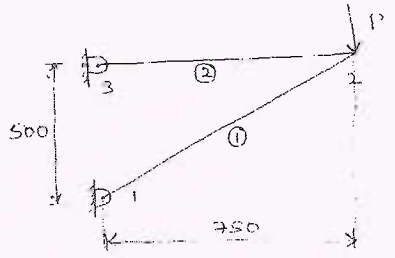


Fig. Q4 (b)

Module-3

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

b. For the beam element shown in figure Q5 (b), determine the displacement and slope at the free end. Take E = 70 GPa, $I = 4\times10^{-4}$ m^4 **(08 Marks)**

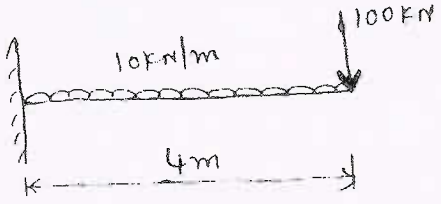
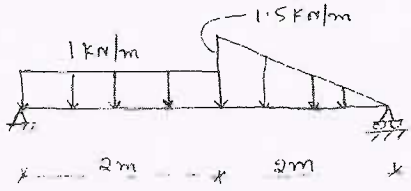


Fig. Q5 (b)

OR

6 a. Derive the stiffness matrix for a torsion element. **(06 Marks)**

b. Find the deflection and slopes at the nodes for the aluminium beam shown in Fig. Q6 (b). **(10 Marks)**



E = 70 GPa

$I = 2\times10^{-6} m^4$

Fig. Q6 (b)

Module-4

7 a. With brief explanation obtain the rate equation that describes the rate of energy flow for the following conditions:
(i) Conduction (ii) Convection (iii) Radiation **(06 Marks)**

b. Derive the shape function of a 1 D bar element with temperature T_1 and T_2 at the nodes. **(10 Marks)**

OR

8 a. Determine the temperature distribution in the rectangular fin shown in Fig. Q8 (a). Neglect convection heat transfer and assume heat generated inside the fin as 500 W/m^3 **(08 Marks)**

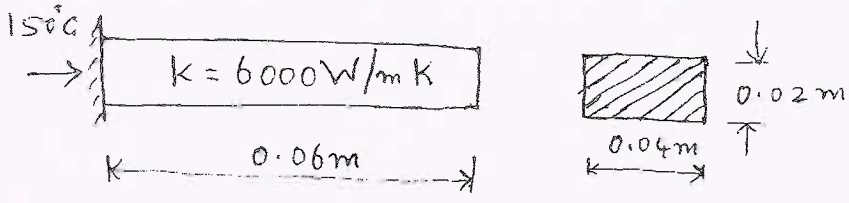


Fig. Q8 (a)

b. Derive the stiffness matrix for fluid flow in 1 D bar element. **(08 Marks)**

Module-5

9 Derive the shape function for axisymmetric triangular element. **(16 Marks)**

OR

10 Derive the consistent mass matrix for the following:
(i) 1 D bar element.
(ii) 1 D truss element. **(16 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

15ME63

Sixth Semester B.E. Degree Examination, Dec.2019/Jan.2020
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 is permitted.

Module-1

1 a. Elaborate basic laws governing modes of heat transfer. **(06 Marks)**

b. Explain what do you mean by thermal contact resistance. **(02 Marks)**

c. The surface of a spherical container with 0.4 m outer diameter is at −195°C. Two layers of insulation each of 2.5 cm thickness is added. The thermal conductivities of the materials are 0.004 and 0.03 W/mK. The contact resistances are each of 5×10^{-4} $m^2°CW$. The outside is exposed to air at 30°C with a convection coefficient of 16 W/m^2K. Determine the heat gain and the temperatures at various surfaces and also the drops due to contact resistance. **(08 Marks)**

OR

2 a. Explain the types of boundary conditions involved in heat transfer problems. **(06 Marks)**

b. Write down the general heat conduction equation in (i) cylindrical coordinate system (ii) spherical coordinate system. **(02 Marks)**

c. A composite slab is made of three layers 15 cm, 10 cm and 12 cm thickness. The first layer is of material with K = 2.5 W/mK, and occupies 60% of area and the rest is of K = 1.45 W/mK. The second layer is made of material 12.5 W/mK for 50% area and remaining is of material with K = 18.5 W/mK. The third layer is of single material with K = 0.76 W/mK. The slab is exposed to warm air at 26°C and cold air at −20°c on the other side. The convective coefficients are 15 and 20 W/m^2K on the inside and outside respectively. Determine heat flow and interface temperatures. **(08 Marks)**

Module-2

3 a. Derive the equation of temperature distribution for long fin with usual notations. **(08 Marks)**

b. Circumferential fins of constant thickness of 1 mm are fixed on a 50 mm pipe at a pitch of 9 mm. The fin length is 20 mm. The wall temperature is 130°C. The K = 210 W/mK. The convective coefficient is 50 W/m^2K. Determine heat flow and effectiveness. **(08 Marks)**

OR

4 a. Derive equation of temperature distribution using lumped parameter model. **(08 Marks)**

b. A concrete wall initially at 30°C is exposed to gases at 900°C with h = 85 W/m^2K. The thermal diffusivity is 4.92×10^{-7} m^2/s. the K of material is 1.28 W/mK. Determine the temperature of the surface and temperatures at 1 cm depth and also 5 cm depth after 1 hr. Also estimate the heat flow at the surface at the instant. **(08 Marks)**

Module-3

5 a. Derive solution to differential equation for steady two dimensional conduction with usual notations. **(08 Marks)**

b. A plate 1m × 2m side has both its 2m sides and one 1m side at 100°C. The temperature along the fourth side is given by $T = 400\sin\left(\frac{\pi x}{l}\right) + 100$ where x is in m from the corner and t is in °C. Determine temperature taking 1m on x direction and 2m on y direction at following locations (i) (0.25, 0.5) (ii) (0.25, 1) (iii) (0.5, 1.5) (iv) (0.5, 2.0) **(08 Marks)**

OR

6 a. Define and explain the following:
i) Black body ii) Shape factor
iii) Wein's displacement law iv) Kirchoff's law **(08 Marks)**

b. Two large parallel planes are at 1000 K and 600 K. Determine the heat exchange per unit area.
(i) If surfaces are black
(ii) If the hot one has an emissivity of 0.8 and cooler one 0.5
(iii) If a large plate is inserted between these two, having emissivity of 0.2. **(08 Marks)**

Module-4

7 a. Explain formation of hydrodynamic and thermal boundary layers. **(08 Marks)**

b. A flat heater of circular shape of 0.2 m dia with a heat generation of 1.2 KW/m^2 is kept in still air at 20°C with heated surface facing downward and inclined at 15° to the horizontal. Determine heat transfer coefficient. **(08 Marks)**

OR

8 a. Write the importance of the following:
(i) Grashoff number
(ii) Prandtl number
(iii) Reynolds number
(iv) Stanton number **(08 Marks)**

b. Nitrogen at −20°C gets heated as it flows through a pipe of 25 mm dia at a flow rate of 13.72 kg/hr at 1 atm pressure. Determine the value of pipe temperature at the exit where pipe is heated with uniform heat flux of 500 W/m^2 and pipe is 4m long. Take Cp of nitrogen as 1030 J/kgK. **(08 Marks)**

Module-5

9 a. Sketch and explain regimes of pool boiling. **(08 Marks)**

b. Water at atmospheric pressure is boiling on a brass surface heated from below. If the surface is at 108°C, determine the heat flux and compare the same with critical heat flux. **(08 Marks)**

OR

10 a. Derive CMTD for parallel flow heat exchanger. **(08 Marks)**

b. In a shell and tube heat exchanger/condenser, the tube bank is 10 rows deep with ID of tube 20 mm and OD 25 mm. the tubes are arranged in square array of 50 mm pitch. Water flows across the tubes with V = 0.5 m/s. Sea water flows inside with 1 m/s. The water is cooled from 50°C to 30°C and sea water temperature changes from 15°C to 25°C. Assuming same properties for both side water, determine overall heat transfer coefficient. The tubes are of brass with K = 60.6 W/mK. Assume tube length of 4m. **(08 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

15ME64

Sixth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Design of Machine Elements – II

Time: 3 hrs. Max. Marks: 80

Note: 1. *Answer FIVE full questions, choosing one full question from each module.*
2. *Use of design data hand book is permitted.*
3. *Missing data can be suitable assumed.*

Module-1

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

b. A chain link is made of 16 mm diameter steel rod. The mean radius of the semicircular end is 50 mm and the length of the straight portion of the link is 80 mm. Determine the maximum tensile and compressive stress when the link is subjected to a pull of 5 KN. **(12 Marks)**

OR

2 a. The following data refers a diesel engine:
Inside cylinder diameter = 150 mm, Explosion pressure = 5 N/mm^2; Material for the cylinder and head = Grey CI FG150; Factor of safety = 5
Design (i) Cylinder (ii) Head. **(05 Marks)**

b. A cast iron cylindrical pipe of outside diameter 300 mm and inside diameter 200 mm is subjected to an internal fluid pressure of 20 N/mm^2 and external pressure of 5 N/mm^2. Determine the tangential and radial stresses at the inner and outer surface. Also sketch the tangential stress and radial stress distribution across its thickness. **(11 Marks)**

Module-2

3 a. Explain concept of slip and creep in belt drive. **(04 Marks)**

b. Select a V-belt to transmit 10 kW of power from a pulley of 200 mm diameter mounted on an electric motor running at 720 rpm to another pulley mounted on compressor running at 200 rpm. The service is heavy duty varying from 10 Hrs to 14 Hrs per day and centre distance between centre of pulleys is 600 mm. **(12 Marks)**

OR

4 a. In a block and tackle mechanism, 3 pulleys at the top and 2 pulleys at the bottom block. Derive an expression for the effort required to raise the load in terms of load to be lift and pulley co-efficient. **(05 Marks)**

b. Explain any two types of chain used for power transmission. **(03 Marks)**

c. A loaded narrow gauge car weighs 18 KN and moving at velocity of 80 m/min is brought to rest by a buffer consists of two helical springs. In bringing the car to rest the spring undergoes a compression of 200 mm. The allowable shear stress is 0.3 GPa and the spring index is 8. Design a suitable spring. Take modulus of rigidity 84 GPa. **(08 Marks)**

Module-3

5 a. Give a detailed classification of gears. **(04 Marks)**

b. Design a pair of spur gears to transmit a power of 20 kW from a shaft at 1000 rpm to a parallel shaft which is to rotate at 310 rpm. Assume number of teeth on pinion 31 and 20° full depth involute tooth form. The material for pinion is C40 steel interated and for gear cast steel 0.20% C untreated. **(12 Marks)**

OR

6 a. Derive an equation for beam strength of helical gear. **(04 Marks)**

b. A pair of mitre gears has pitch diameter 280 mm and face width of 36 mm and runs at 250 rpm. The teeth are $14\frac{1}{2}^{\circ}$ involute profile and accurately cut and transmit 6 kW. Neglect friction angle, find the following:

(i) Outside diameter of gears.
(ii) Resultant tooth load tangent to pitch cone.
(iii) Radial load on the pinion.
(iv) Thrust on the pinion. **(12 Marks)**

Module-4

7 a. Complete the design and determine the input capacity of the worm gear speed reducer unit which consists of a hardened steel worm and a phosphor bronze gear having 20° stub involute teeth. The centre distance is 200 mm, transmission ratio is 10 and worm speed is 2000 rpm. **(12 Marks)**

b. Design a single plate clutch consists of two pairs of contacting surfaces for a torque capacity of 200 N-m. Due to space limitations the outside diameter of the clutch is to be 250 mm. **(04 Marks)**

OR

8 a. List friction materials used in clutch. Also derive an expression for torque transmitted by plate clutch. Assume uniform wear theory. **(06 Marks)**

b. A differential band brake has an operating lever 225 mm long. The ends of the brake band are attached so that their operating arms are 38 mm and 127 mm long. Brake drum diameter is 600 mm, Arc of contact is 300° and co-efficient of friction is 0.22. The band is 3.2 mm × 100mm .

(i) Find the least force required at the end of operating lever when the band is subjected to a stress of 55 N/mm^2.
(ii) What is the torque applied to the brake drum shaft?
(iii) Is this brake self locking? Proove your answer. **(10 Marks)**

Module-5

9 a. Derive Petroff's equation for a lightly loaded bearing. **(05 Marks)**

b. Design the main bearing of a steam turbine that runs at 1800 rpm. The load on the bearing is estimated to be 2500 N. Assume SAE 20 grade oil. **(11 Marks)**

OR

10 a. List and explain types of roller bearings. **(06 Marks)**

b. Derive an expression for reliability of a bearing. **(04 Marks)**

c. The rolling contact ball bearing are to be selected to support the overhung countershaft. The shaft speed is 720 rpm. The bearings are to have 99% reliability corresponding to a life of 24000 Hrs. The bearing is subjected to an equivalent radial load of 1 kN. Consider life adjustment factors for operating condition and material as 0.9 and 0.85 respectively. Find the basic dynamic load rating of the bearing from manufacture's catalogue, specified at 90% reliability. **(06 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

17ME51

Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020
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 Interest factors 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)**

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. Discuss the three types of leadership styles mentioning their advantages and disadvantages. **(10 Marks)**

b. With the aid of block diagram, explain Maslow's Hierarchy of Needs theory. **(10 Marks)**

Module-3

5 a. Engineers are now expected not only to generate novel technological solution but also to make skillfull financial analysis of the effects of implementation – discuss. **(06 Marks)**

b. State and explain the law of supply and demand mentioning the factors influencing it. **(08 Marks)**

c. Determine the effective interest rate for a nominal annual rate of 6% that is compounded:
(i) Semi-annually (ii) Quarterly (iii) Monthly (iv) Daily **(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 person wishes to have a future sum of Rs.1,00,000 for his son's education after 10 years from now. What is the single payment that he should deposit now so that he gets desired amount after 10 years? The bank gives 15% interest rate compounded annually. **(04 Marks)**

c. A celebrity is at the height of his career. He wants to invest Rs.10 lakhs from the end of this year and follow it up with 9 lakhs, 8 lakhs and so on for the next five years, when his income would go on diminishing. Find the maturity amount 6 years later if a film producer agrees to pay him 15% rate of interest, compounded annually. **(08 Marks)**

Module-4

7 a. An engineer has two bids for an elevator to be installed in a new building. The details of the bids for the elevators are as follows:

Bid	Engineer's estimates		
	Initial cost (Rs.)	Service life (years)	Annual Operations & Maintenance Cost (Rs.)
Alpha Elevator Inc.	4,50,000	15	27,000
Beta Elevator Inc.	5,40,000	15	28,500

Determine which bid should be accepted, based on the present worth method of comparison assuming 15% interest rate, compounded annually. **(10 Marks)**

b. A person owns a corner plot. He must decide which of the several alternatives to select in trying to obtain a desirable return on his investment. After much study and calculation, he decides that two best alternatives are given in the following table:

Particulars	Alternative I	Alternative II
First cost (Rs.)	20,00,000	36,00,000
Annual property taxes (Rs.)	80,000	1,50,000
Annual Income (Rs.)	8,00,000	9,80,000
Life of building (years)	20	20
Salvage Value (Rs.)	0	0

Evaluate the alternatives based on the Future Worth Method at i = 12%. **(10 Marks)**

OR

8 a. Define the following terms: (i) MARR (ii) IRR (iii) ERR **(05 Marks)**

b. What are the clues for IRR calculations? **(05 Marks)**

c. Farmhouse can be purchased for Rs.90,000 and the expected resale value after 20 years is Rs.60,000. If the annual rental income is Rs.11,800 and expenses Rs.4700, what will be the rate of return earned on this farmhouse? **(10 Marks)**

Module-5

9 a. Explain how selling price is determined for a product with a block diagram. **(06 Marks)**

b. The expenditure incurred in manufacturing a machine is as follows:

1.	Material consumed	Rs.55,00,000
2.	Indirect factory wages	Rs.8,00,000
3.	Director's fee	Rs.3,00,000
4.	Advertisement	Rs.1,00,000
5.	Net profit	Rs.1,20,000
6.	Depreciation on sales department car	Rs.11,000
7.	Printing & Stationary	Rs.2500
8.	Depreciation of plant	Rs.45,000
9.	Direct wages	Rs.6,50,000
10.	Factory rent	Rs.60,000
11.	Telephone & postage charges	Rs.15,000
12.	Gas & Electricity	Rs.50,000
13.	Office salaries	Rs.2,10,000
14.	Office rent	Rs.50,000
15.	Showroom rent	Rs.1,50,000
16.	Salesman commission	Rs.26,500
17.	Sales dept. car expenses	Rs.15,000

Estimate the selling price. **(14 Marks)**

OR

10 a. List and explain five methods of depreciation. **(10 Marks)**

b. Discuss the various causes of depreciation. **(05 Marks)**

c. A company has purchased an equipment whose first cost is Rs.1,00,000 with an estimated life of Eight years. The estimated salvage value of the equipment at the end of its life time is Rs.20,000. Determine the depreciation charge and book value at the end of various (eight) years using straight line method of depreciation. **(05 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

17ME52

Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Dynamics of Machinery

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Enumerate the concept of 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. A four bar mechanism is shown in Fig.Q1(b), which is acted upon by a force $P = 100 \angle 120^\circ$ N on link CD. The dimensions of various link are AB = 40 mm, BC = 60 mm, CD = 50 mm, DA = 30 mm and DE = 20 mm. Determine the magnitude and direction of input torque T_2 on link AB for static equilibrium of the mechanism.

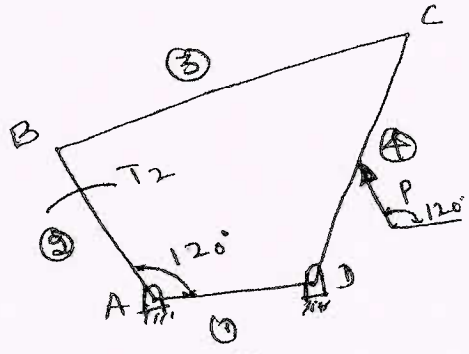


Fig.Q1(b) **(14 Marks)**

OR

2 a. Explain the D'Alembert's principle and discuss on its significance. **(04 Marks)**

b. In a vertical double acting engine, the connecting rod is 4.5 times the crank. Stroke of the piston is 400 mm and the mass of the reciprocating parts is 100 kg. The engine runs at 250 rpm. If the net load on the piston due to steam pressure is 25 kN, when the crank has turned through an angle of 120° from top dead centre. Determine :

(i) Net force on the piston
(ii) Thrust in the connecting rod along connecting rod
(iii) Thrust on the sides of cylinder walls
(iv) Crank pin effort
(v) Thrust on crank shaft bearing
(vi) Turning moment on the crank shaft **(16 Marks)**

Module-2

3 a. Discuss on the concept of static and dynamic balancing. **(04 Marks)**

b. Four masses A, B, C and D are completely balanced. Masses C and D make angles of 90° and 210° respectively with B in the same sense. The plane containing B and C are 300 mm apart. Masses A, B, C and D can be assumed to be concentrated at radii of 360 mm, 480 mm, 240 mm and 300 mm respectively. The massed B, C and D are 15 kg, 25 kg and 20 kg respectively. Determine:

(i) Mass A and its angular position
(ii) Position of planes A and D. **(16 Marks)**

OR

4 A four crank engine has two outer cranks set at 120° to each other and their reciprocating masses are 400 kg each. The distance between the planes of rotation of adjacent cranks are 450 mm, 750 mm and 600 mm. If the engine is to be incomplete primary balance, find the reciprocating mass and the relative angular position for each of the inner cranks. If the length of each crank is 300 mm, length of each connecting rod is 1.2 m and the speed of rotation is 240 rpm, what is the maximum secondary unbalanced force? **(20 Marks)**

Module-3

5 a. Explain the following term relative governors:
(i) Stability
(ii) Sensitiveness
(iii) Isochromism
(iv) Hunting **(04 Marks)**

b. The arms of a porter governor are each 250 mm long and pivoted on the governor axis. The mass of each ball is 5 kg and the mass of central sleeve is 30 kg. The radius of rotation of the balls is 150 mm, when the sleeve begins to rise and reaches a value of 200 mm for maximum speed. Determine the range of the Governor. If the friction at the sleeve is equivalent of 20 N of load at the Sleeve. Determine how the speed range is modified. **(16 Marks)**

OR

6 a. With neat sketches, enumerate on the effect of Gyroscopic couple on the steering, pitching and rolling of a ship. **(09 Marks)**

b. A ship is propelled by a rotor of mass of 2000 kg rotates at a speed of 2400 rpm. The radius of gyration of rotor is 0.4 m and spins clockwise direction, when viewed from bow (Front) end. Find the gyroscopic couple and its effect when
(i) The ship takes left turn at a radius of 350 m with a speed of 35 kmph.
(ii) The ship pitches with the bow rising at angular velocity of 1 rad/sec.
(iii) The ship rolls at an angular velocity of 0.15 rad/sec. **(11 Marks)**

Module-4

7 a. Define the following terms:
(i) Simple Harmonic Motion
(ii) Resonance
(iii) Natural frequency
(iv) Phase difference **(08 Marks)**

b. Add the following harmonic motions analytically and check the solution graphically:
$x_1 = 4\cos(\omega t + 10^\circ)$ and $x_2 = 6\sin(\omega t + 60^\circ)$ **(12 Marks)**

OR

8 a. Explain the energy method of finding natural frequency of spring-mass system. **(10 Marks)**

b. Find the natural frequency of the system shown in Fig.Q8(b).

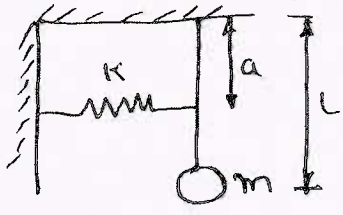


Fig.Q8(b) **(10 Marks)**

Module-5

9 a. Set up a differential equation for a spring mass damper system and obtain complete solution for a under damped system. **(10 Marks)**

b. The measurement on a mechanical vibrating system shows that the mass of 10 kg and that the spring can be combined to give an equal spring stiffness of 5 N/mm. If the vibrating system have a dashpot attached which exerts a force of 40 N when the mass have a unit velocity of 1 m/sec. Determine:

(i) Critical damping coefficient
(ii) Damping factor
(iii) Logarithmic decrement
(iv) Ratio of any two consecutive amplitude **(10 Marks)**

OR

10 a. Derive an expression for magnification factor or amplitude ratio for spring mass system with viscous damping subjected to Harmonic force. **(10 Marks)**

b. A mass of 100 kg has been mounted on a spring dash pot system having stiffness of 19,600 N/m and damping coefficient 100 N-S/m. The mass acted upon by a harmonic force of 39 N at the undamped natural frequency of the system. Find:

(i) Amplitude of vibration of the mass
(ii) Phase difference between the force and displacement
(iii) Force transmissibility ratio **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

17ME53

Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020
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 Turbomachine. With neat sketch, explain the parts of Turbomachine. **(04 Marks)**

b. Define specific speed of pump. Derive an expression for the same in terms of discharge speed and head. **(06 Marks)**

c. A Fransis turbine model is built to scale 1:5 the data for the model is P = 4kW, N = 3500rpm H = 2m and prototype H = 6m. Assume that the overall efficiency of the model as 70%. Calculate: i) Speed of the prototype ii) Power of the prototype. Use Moody's equation. **(10 Marks)**

OR

2 a. Define Polytropic Efficiency of turbine. Show that the Polytropic Efficiency during Expansion process is given by $\eta_p = \dfrac{\ln \frac{T_2}{T_1}}{\frac{\gamma-1}{\gamma} \ln \frac{P_2}{P_1}}$ **(10 Marks)**

b. In a three stage turbine the pressure ratio of each stage is 2 and stage efficiency is 0.75. Calculate overall efficiency and reheat factor. **(10 Marks)**

Module-2

3 a. Derive alternate form of Euler's turbine equation and explain the significance of each energy component. **(10 Marks)**

b. At a 50% reaction stage axial flow turbine the mean blade diameter is 0.6mts. The maximum utilization factor is 0.85 and steam flow rate is 12kg/sec. Calculate the inlet and outlet absolute velocities and power developed if the speed is 2500rpm. **(10 Marks)**

OR

4 a. In a turbomachine prove that the maximum utilization factor is given by $\epsilon_{max} = \dfrac{2\phi \cos\alpha_1}{1 + 2\phi R \cos\alpha_1}$ where ϕ = speed ration, R = degree of reaction, α_1 = nozzle angle. **(10 Marks)**

b. Draw the velocity triangles at inlet and outlet of an axial flow compressor from the following data. Degree of reaction 0.5 inlet blade angle 45°. Axial velocity of flow which is constant throughout 120m/sec, speed of rotation 6500rpm, radius of rotation 20cm, blade speed of inlet is equal to blade speed at outlet. Calculate angles at inlet and outlet. Also calculate power needed to handle 1.5kg/s of air. **(10 Marks)**

Module-3

5 a. Why compounding of steam turbine necessary? Describe the velocity compounding of steam turbine with neat sketch. **(08 Marks)**

b. Show that for a two row Curtis steam turbine stage in the absence of friction for axial discharge at exit under maximum utilization condition $U/V_1 = \dfrac{\cos\alpha_1}{4}$ where U = blade speed V_1 = absolute velocity at inlet α_1 = nozzle angle at inlet. **(12 Marks)**

OR

6 a. Define degree of reaction for reaction turbine and derive an expression for the some for 50% reaction turbine. **(10 Marks)**

b. In a Parson's turbine, the axial velocity of flow of steam is 0.5 times the mean blade speed. The outlet angle of the blade is 20° diameter of the blade ring is 1.3m and rotational speed 3000rpm. Determine inlet blade angles, power developed for steam flow of 65kg/sec and isentropic enthalpy drop, if the stage efficiency is 80%. **(10 Marks)**

Module-4

7 a. Show that the specific speed of Pelton wheel is given by $n_s = 206.63\frac{\sqrt{n}}{m}$ where n = number of jets used for the flow, m = wheel diameter to jet diameter ratio. Assume the jet velocity coefficient as 0.97 speed ratio as 0.45 and efficiency of the turbine as 0.89. **(08 Marks)**

b. A double overhung Pelton wheel unit is to produce 30000 kW of a generator under an effective head 300m at the base of the nozzle. Find the size of the jet. Mean diameter of the runner speed and specific speed of each Pelton turbine. Assume generator η = 93% Pelton wheel η = 0.85 speed ratio = 0.46 jet velocity co-coefficient = 0.97 and jet ratio = 12. **(12 Marks)**

OR

8 a. Draw a neat sketch of Francis turbine. Explain the function of draft tube. Also draw the typical velocity triangles of Fransis turbine. **(08 Marks)**

b. A Kaplan turbine working under head of 20m develops 11772kW of shaft power. The outer diameter of the runner is 3.5m and hub diameter is 1.75m. The guide blade angle of the extreme edge of the runner is 35°. The hydraulic and overall efficiencies of the turbine are 88% and 84% respectively. If the velocity of whirl is zero at outlet, determine: i) Runner vane angle at the inlet and outlet at the extreme edge of the runner ii) Speed of turbine. **(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 $\Delta p = \frac{\rho}{2}\left[Vf_1^2 + U_2^2 - Vf_2^2 \cos ec^2\beta_2\right]$. Vf_1 and Vf_2 are velocity of flow at inlet and outlet of the impeller U_2 = tangential speed of impeller at exit, β_2 = exit blade angle. **(10 Marks)**

b. A centrifugal pump is running at 1000 rpm. The outlet vane angle of the impeller is 45° and the velocity of flow of the outlet is 2.5m/sec. The discharge through the pump is $0.2m^3$/sec. When the pump is working against a head of 20m. If the monometric efficiency is 80% draw the outlet velocity diagram and calculate : i) The diameter of the impeller at the outlet ii) width of impeller at the outlet. **(10 Marks)**

OR

10 a. With reference to centrifugal air compressor, explain the following:
i) PreWhirl ii) Surging iii) Slip factor iv) Choking. **(10 Marks)**

b. A centrifugal compressor runs at a speed of 15000rpm and delivers air at 30kg/sec, exit radius is 0.35m, relative velocity and vane angles at exit are 100m/s and 75° respectively. Assuming axial inlet and inlet stagnation temperature and pressure as 300K and 1 bar respectively, calculate: i) Torque ii) The power required to drive compressor iii) The ideal head developed iv) The workdone v) The exit total pressure $(cp)_{air}$ = 1.005kJ/kgK. **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

17ME54

Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Design of Machine Elements – I

Time: 3 hrs. Max. Marks: 100

Note: 1. *Answer FIVE full questions, choosing one full question from each module.*
2. *Use of design data hand book permitted.*

Module-1

1 a. With flow diagram, explain the phases of design. **(05 Marks)**

b. List and explain the factors to be considered for selection of material for a machine component. **(05 Marks)**

c. A point in a structural member is subjected to plane stress as shown in Fig. Q1 (c). Determine the following :
(i) Normal and tangential stress on a plane inclined at 45°.
(ii) Principal stresses and directions.
(iii) Maximum shear stress. **(10 Marks)**

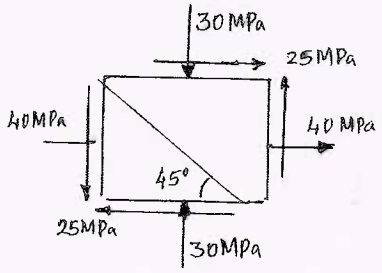


Fig. Q1 (c)

OR

2 a. What is stress concentration? Explain with neat sketches any three methods to reduce stress concentration in machine elements. **(05 Marks)**

b. A round shaft made of Grey Cast Iron FG200 with σ_{ut} = 200 MPa, is subjected to a bending moment of 15 N.m is as shown in Fig. Q2 (b). The theoretical stress concentration factor at fillet is 1.5. Determine the diameter 'd' and max stress at the fillet. **(05 Marks)**

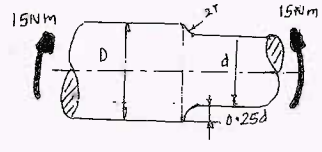


Fig. Q2 (b)

c. A 50 mm steel rod supports a 9 kN load in addition to this a torsional moment of 100 N.m is applied on it as shown in Fig. Q2 (c). Determine the maximum tensile and maximum shear stresses. **(10 Marks)**

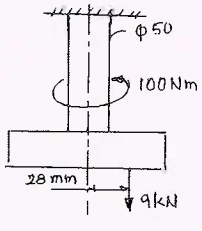


Fig. Q2 (c)

Module-2

3 a. Explain with sketches, the different types of varying stresses. **(05 Marks)**

b. Derive Soderberg equation for designing members subjected to fatigue loading. **(05 Marks)**

c. A steel cantilever beam is 200 mm long. It is subjected to an axial load varies from 150 N (compression) to 450 N (tension) and a transverse load at its free and which varies from 80 N (up) to 120 N (down). The Cantilever beam is of circular cross section having a diameter of 2 d for the first 50 mm and diameter 'd' for the remaining length. Determine its diameter using the following data. Use Soderberg equation.
Factor of safety = 2 ; Yield stress = 330 MPa; Endurance limit = 300 MPa
Stress concentration factor = 1.44 for bending,
1.64 for axial loading,
load correction factor = 0.7 for axial loading
1 for bending
Size correction factor = 0.85; Notch sensitivity = 0.9
Surface correction factor = 0.9 **(10 Marks)**

OR

4 a. Derive an expression for impact stress induced in a member subjected to axial load. **(05 Marks)**

b. Design a rod of solid circular cross section of length 200 mm (placed vertical) to sustain an axial compressive load of 1000 N, that falls on it from a height of 10 mm. The material selected has a design stress of 80 N/mm^2 and Young's modulus = 2.1×10^5 N/mm^2. **(05 Marks)**

c. A mass of 500 kg is being lowered by means of a steel wire rope having cross sectional area 250 mm^2. The velocity of the weight is 0.5 m/s, when the length of the extended rope is 20 m. the sheave gets stuck up. Determine the stress induced in the rope due to sudden stoppage of the sheave. Neglect friction. Take E = 190 GPa. **(10 Marks)**

Module-3

5 A commercial steel shaft with allowable shear stress 40 MPa. With shock factors for bending and twisting is 1.5 and 1 respectively. The length of the shaft between bearings is 600 mm, carries a pulley of 400 mm dia meter having weight 400 N, mounted in middle of the shaft. Shaft receives 40 kW at 600 rpm by a flat belt drive. Power from motor shaft is transmitted through another pulley of diameter 600 mm weighing 600 N overhanging the right hand bearing by 200 mm. The belt drives on pulleys are right angles to each other. Take ratios of belt tensions as 3, determine the diameter of the shaft. Use ASME code for shaft design. **(20 Marks)**

OR

6 a. Design a protected type CI flange coupling for a steel shaft transmitting 30 kW at 200 rpm. The allowable shear stress in the shaft and key materials 40 MPa. The maximum torque transmitted is 20% greater than full load torque. The allowable shear stress in the bolt is 60 MPa and allowable shear stress in the flange is 40 MPa. **(10 Marks)**

b. Design a socket and spigot type of cotter joint to connect two rods subjected to steady axial pull of 100 kN. The material used for socket end, spigot end and cotter is cast steel with σ_y = 328.6 MPa, take FoS as 4 for tension, 6 for shear and 3 for crushing based on tensile yield strength. **(10 Marks)**

Module-4

7 a. Design a triple riveted longitudinal double strap butt joint with unequal strap for a boiler. The inside diameter of the longest course of the drum is 1.3 m. The joint is to be designed for a steam pressure of 2.4 N/mm^2. The working stresses to be used are $\sigma_t = 77$ MPa for plate material in tension, $\tau = 62$ MPa for rivet material in shear, $\sigma_c = 120$ MPa for rivet material in compression. Assume joint efficiency as 81%. **(10 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. **(10 Marks)**

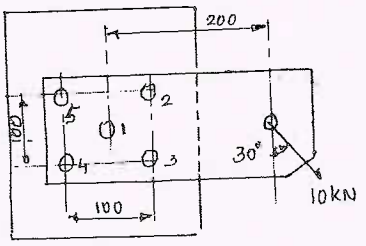


Fig. Q7 (b)

OR

8 a. The following Fig. Q8 (a) shows connections of eccentrically loaded welded joint. The allowable shear stress in the fillet weld using MS bar electrodes can be taken as 80 N/mm^2, find the thickness of the plate. **(10 Marks)**

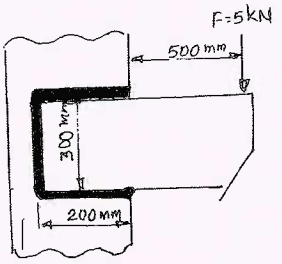


Fig. Q8 (a)

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 weld if the permissible shear stress in the weld material is 75 MPa. **(10 Marks)**

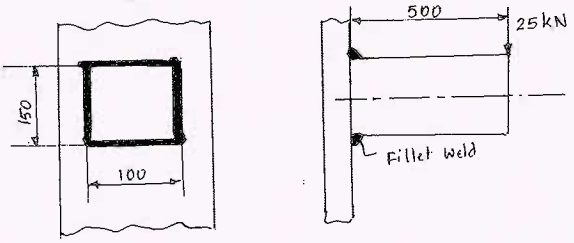


Fig. Q8 (b)

Module-5

9 a. 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 the initial tension required in each bolt is 40 kN, determine the factor of safety. **(10 Marks)**

b. In a hand vice, the screw has double start Acme thread of 25 mm internal diameter and 4 mm pitch. If the length of the lever is 300 mm; the maximum force that can be applied at the end of the lever is 250 N. Determine the force with which the job is held between the jaws of the vice. Take co-efficient of friction at the thread is 0.14, angle of thread $2\theta = 29^\circ$. Neglect collar friction. **(10 Marks)**

OR

10 a. Explain self locking and overhauling. Derive an expression for torque required to lift the load on square threaded screw. **(10 Marks)**

b. A single threaded power screw of 25 mm diameter with a pitch of 5 mm, a vertical load on the screw reaches a maximum load of 500 N. The co-efficients of friction are 0.05 for the collar and 0.08 for the screw. The frictional diameter of the collar is 30 mm. Find the torque required to rise and lower the load. Also find the efficiency of the power screw. **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

17ME554

Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020
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. Define Non-Traditional Machining. What are the need for N.T.M process. Explain briefly. **(06 Marks)**

b. What are the comparison between conventional and non-conventional machining. **(06 Marks)**

c. What are the various aspects to be considered before selecting a N.T.M process? Discuss briefly. **(08 Marks)**

OR

2 a. Give classification of N.T.M process. **(06 Marks)**

b. What are the specific advantages, limitations and applications of non-traditional machining processes? **(10 Marks)**

c. Enumerate the physical parameters of the Non-traditional machining process. **(04 Marks)**

Module-2

3 a. With the help of neat sketch, explain working principle of ultrasonic machining process. **(10 Marks)**

b. Explain with neat diagrams, process parameters in USM. **(06 Marks)**

c. What are the process characteristics of USM? Explain briefly. **(04 Marks)**

OR

4 a. Explain with neat sketch, working principle of Abrasive Jet machining and also give advantages and applications of A.J.M process. **(10 Marks)**

b. With the help of neat sketch, explain water jet machining process and also give advantages and disadvantages of W.J.M. **(10 Marks)**

Module-3

5 a. With a neat sketch, explain the working principle of ECM process. **(10 Marks)**

b. Explain with a neat sketch, Electro Chemical Grinding (ECG). **(06 Marks)**

c. What are the process parameters of ECM? Explain briefly. **(04 Marks)**

OR

6 a. Explain the following in Chemical Machining Process :
i) Maskants ii) Etchants. **(06 Marks)**

b. Sketch and explain Electro Chemical Honing (ECH). **(06 Marks)**

c. Explain with neat sketches of chemical blanking and Chemical Milling process. **(08 Marks)**

Module-4

7 a. With the help of a neat diagram, working principle of Electrical Discharge Machining process. **(08 Marks)**

b. Explain with neat sketch, the travelling wire EDM process. **(06 Marks)**

c. Mention various dielectric flow pattern of EDM process. Explain any two with sketches. **(06 Marks)**

OR

8 a. Explain with neat diagram, construction and working principle of Plasma Arc Machining (PAM). **(10 Marks)**

b. What are the process parameters of PAM? Explain briefly. **(05 Marks)**

c. What are the safety precautions in PAM? Explain. **(05 Marks)**

Module-5

9 a. Explain with neat sketch, working principle of Laser Beam Machining process (LBM). **(08 Marks)**

b. What are the advantages, limitations and applications of LBM? **(06 Marks)**

c. What are the process parameters and characteristics of LBM? **(06 Marks)**

OR

10 a. Explain with the help of a neat diagram, Operation Principle of Electron Beam Machining (EBM). **(10 Marks)**

b. What are the advantages , limitations and applications of EBM process? **(06 Marks)**

c. Explain need for EBM and mechanism of metal removal of EBM process. **(04 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

17ME564

Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Project Management

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define project and list its characteristics. (08 Marks)
b. Explain the general project life cycle with neat sketch. (12 Marks)

OR

2 a. Explain the steps involved in the strategic planning process. (12 Marks)
b. Discuss the project selection methods. (08 Marks)

Module-2

3 a. Explain work breakdown structure in detail. (10 Marks)
b. Write short notes on:
(i) Uncertainty in project schedule
(ii) Project scope (10 Marks)

OR

4 a. Explain the stages in project planning in detail. (10 Marks)
b. Explain the project scheduling process, its development and its purpose. (10 Marks)

Module-3

5 a. Explain cost planning, cost estimating and cost budgeting. (10 Marks)
b. Discuss the abilities needed when resourcing projects. (10 Marks)

OR

6 a. Explain briefly Risk Identification and Risk Analysis involved in Project Management. (10 Marks)
b. What do you understand by project quality tools and explain Kick off projects? (10 Marks)

Module-4

7 a. Explain the process involved in project supply chain management. (10 Marks)
b. Explain different types of contract with examples. (10 Marks)

OR

8 a. Explain the process carried out in project balanced score card approach. (10 Marks)
b. What is Knowledge Management? How does Knowledge Management help in Project Management? (10 Marks)

Module-5

9 a. Write notes on:
(i) Rules for drawing a network
(ii) Errors committed while drawing a network (08 Marks)

b. The following table shows jobs of the network along with their time estimates:
   (i) Draw the network
   (ii) Find the expected duration and variance of each activity
   (iii) Calculate the variance and standard deviation of the project length
   (iv) What is the probability that project will be
   - 4 weeks earlier than expected
   - 4 weeks later than expected

Activity	Estimated Duration (weeks)		
1 – 2	1	1	7
1 – 3	1	4	7
2 – 4	2	2	8
2 – 5	1	1	1
3 – 5	2	5	14
4 – 6	2	5	8
5 – 6	3	6	15

(12 Marks)

OR

10 a. Differentiate between PERT and CPM. **(06 Marks)**

b. The table below provides cost and time estimates for a project:
   (i) Draw the network and identify the critical path.
   (ii) Find the normal project duration and cost.
   (iii) Crash the activities so that the project completion time is 9 weeks and also find the cost associated with it.

Activity	Time Estimates (days)		Cost (× Rs.100)	
	Normal	Crash	Normal	Crash
1 – 2	2	1	10	15
1 – 3	8	5	15	21
2 – 4	4	3	20	24
3 – 4	1	1	7	7
3 – 5	2	1	8	15
4 – 6	5	3	10	16
5 – 6	6	2	12	36

(14 Marks)

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

17ME51

Fifth Semester B.E. Degree Examination, Aug./Sept.2020
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 discrete interest factor table is permitted.

Module-1

1 a. Define Management. Explain functions of Management. **(06 Marks)**
b. Explain levels of Management. Specify responsibilities at each level. **(06 Marks)**
c. Explain the contribution of Henri Fayol to the development of management thought. **(08 Marks)**

OR

2 a. Planning precedes all management functions. Elaborate. **(04 Marks)**
b. Explain the steps in planning. **(08 Marks)**
c. Describe various types of plans. **(08 Marks)**

Module-2

3 a. Explain centralization of authority in an organisation. **(04 Marks)**
b. Differentiate between : i) Line organization ii) Line and staff organisation. **(08 Marks)**
c. Explain the process of selection and recruitment. **(08 Marks)**

OR

4 a. Write a note on importance of coordination. **(04 Marks)**
b. Communication is an essential feature of any organization. Explain types of communication based on direction of flow. **(08 Marks)**
c. Mention theories of motivation. Explain i) Maslow's hierarchy of needs theory . ii) Adam's equity theory. **(08 Marks)**

Module-3

5 a. Engineering Economics is part of the curriculum in many universities for engineering courses. Give reasons. **(04 Marks)**
b. Explain the significance of arithmetic gradient factor. **(04 Marks)**
c. Differentiate between the following : i) Microeconomics and Macroeconomics. ii) Price elasticity and income elasticity iii) Demand and Supply. **(12 Marks)**

OR

6 a. State the law of diminishing returns. Where can it be applied? **(04 Marks)**
b. Describe the procedural steps for drawing a cash flow diagram, with the aid of an example. **(08 Marks)**
c. A man lends Rs 1500 at 8% simple interest for 3 years. At the end of this time he invests the entire amount (principal plus interest) at 7% compounded annually for 10 years. How much will he have at the end of 13 – year period? **(08 Marks)**

Module-4

7 a. Explain Payback Comparison method. What are its deficiencies? **(04 Marks)**
b. If you deposit Rs 25000 today, what equal amounts can you withdraw at the end of each quarter for the next four years, when the nominal interest rate is 10%? **(06 Marks)**

c. A publication house offers a 3 year subscription for a down payment of Rs 1000 or a 5 years subscription for down payment of Rs 1250. Magazines worth Rs 520 are dispatched every year. Compare the two offers at 14% p.a. using present worth method. **(10 Marks)**

OR

8 a. Explain present worth comparison method involving assets having infinite lives. **(10 Marks)**

b. A refining company entered into a contract for raw materials with an agreement to pay Rs 6,00,000 now and Rs 150,000 per year beginning at the end of 5^{th} year. The contract was made for 10 years. At the end of 3^{rd} year, because of unexpected profits, the company requested that it be allowed to make a lump – sum payment in advance for the rest of the contract. Both parties agreed that 7% compounded annually was a fair interest rate. What was the amount of the lump – sum? **(10 Marks)**

Module-5

9 a. Define Depreciation. Explain its causes. **(06 Marks)**

b. Initial cost – Rs 150,000 ; Salvage value = Rs 10,000 ; Life = 10 years.
Find the depreciation amount and book value in 5^{th} and 8^{th} year using i) Straight line method ii) Declining balance method iii) Sum of years digit method. **(07 Marks)**

c. A company produces 500 units of a product per day. Direct materials involved is Rs 40,000 , Direct labour Rs 35,000 and Factory overheads Rs 10,000. If the profit is 15% of selling price and selling overheads are30% of factory cost. Calculate selling price per unit. **(07 Marks)**

OR

10 a. Explain how selling price is established giving all components of cost. **(06 Marks)**

b. A company purchased an equipment whose first cost is Rs 2,00,000 with an estimated life of 8 years. The estimated salvage value of the equipment is Rs 40,000 at the end of its life. Determine the depreciation charge and book value at the end of each year using SYD method. **(08 Marks)**

c. An equipment with an initial cost of Rs 70,000 has a life of 5 years, with a salvage value of Rs 10,000. Determine the depreciation charge and book value at the end of 3^{rd} year. Use Double declining balance method. **(06 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

17ME52

Fifth Semester B.E. Degree Examination, Aug./Sept.2020
Dynamics of Machinery

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. State the conditions for the equilibrium of the following systems:
i) Two force member
ii) Three force member
iii) Member with two forces and a torque. **(06 Marks)**

b. In the slider crank mechanism shown in Fig.Q.1(b). The value of force applied to slider 4 is 2kN the dimensions of the various links are AB = 80mm, BC = 240mm, θ = 60°. Determine the forces on various links and the driving torque T_2. **(14 Marks)**

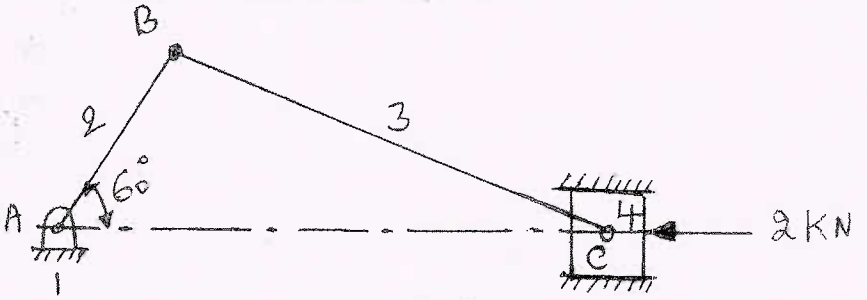


Fig.Q.1(b)

OR

2 a. What is the principal of virtual work? Explain. **(06 Marks)**

b. A four bar mechanism under the action of external force is shown in Fig.Q.2(b). Determine the torque T_2 and various forces on links for the equilibrium of the system. F = 2000N at 45° on CD, AB = 200mm, AD = 215mm, BC = 370mm, DC = 350mm, CE = 100mm. **(14 Marks)**

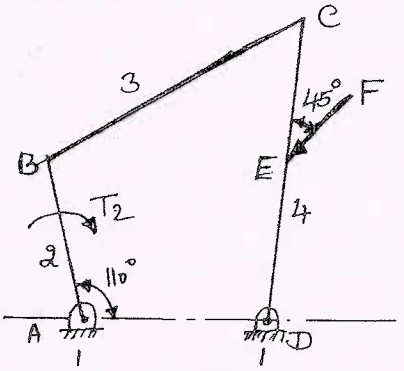


Fig.Q.2(b)

Module-2

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

b. A, B, C and D masses carried by a rotating shaft at radius 100, 125, 200 and 150mm respectively. The planes in which the masses revolving are spaced 600mm apart and the masses B, C and D are 10, 5, 4kg respectively. Find the required mass A and the relative angular positions of the masses to keep the shaft in balance. **(16 Marks)**

OR

4 Crank and connecting rods of a 4 cylinder inline engine running at 1800rpm are 60mm and 240mm respectively and the cylinders are spaced 150mm apart. If the cylinders are numbered 1 to 4 in sequence from one end. The cranks appear at intervals of 90° in an view in the order 1-4-2-3. Reciprocating mass corresponding to each cylinder is 1.5kg. Determine:

a. Unbalanced primary and secondary forces

b. Unbalanced primary and secondary couples with reference to central plane of the engine.

(20 Marks)

Module-3

5 a. Derive an expression for the equilibrium speed of a porter governor. **(06 Marks)**

b. The arms of a porter governor are each 300mm long and are hinged on the axis of rotation. The mass of each ball is 5kg and mass of the sleeve is 15kg. The radius of rotation of the ball is 200mm when the governor begins to lift and 250mm when the governor is at the maximum speed. Determine:

i) Range of speed neglecting the sleeve friction

ii) Range of speed if the frictional force at the sleeve is 30N. **(14 Marks)**

OR

6 a. With usual notations and diagram derive an expression for the gyroscopic couple produced by a rotating disc: **(06 Marks)**

b. A rare engine automobile is travelling along a track of 100m mean radius each of the four road wheels has a mass moment of inertia 2kg-m^2 and effective diameter of 600mm. The rotating parts of the engine have a moment of inertia of 1kg-m^2. The engine axles parallel to the rare axle. When the crank shaft rotates in the same sense as the road wheels, the gear ratio of engine to back axle is 3:1. The vehicle weighs 15000N and has its centre of gravity 500mm above the road level. Determine the limiting speed of the vehicle around the curve for all 4-wheels to maintain contact with the road surface if this is not cambered. **(14 Marks)**

Module-4

7 a. Define the following:

i) Time period

ii) Amplitude

iii) Frequency **(06 Marks)**

b. A body is subjected to two harmonic motions as given below:

$x_1 = 15\sin(wt + 30°)$

$x_2 = 8\cos(wt + 60°)$

Add the two harmonic motions and check it graphically. **(14 Marks)**

OR

8 a. A spring mass system has spring stiffness of K N/m and a mass of M kg. It has a natural frequency of vibration as 10Hz. An extra 3 kg mass is coupled to M and the natural frequency reduces by 3Hz. Find the value of M and spring constant K. **(05 Marks)**

b. A vertical shaft of 100mm in diameter and 1m long has its upper end fixed at the top as shown in Fig.Q.8(b). At the other end it carries a disc of 500kg at a radius of gyration of 450mm. The modulus of rigidity and modulus of elasticity (Young's modulus) for the shaft material are 80GN/m^2 and 200GN/m^2 neglecting the weight of the shaft. Determine:
   i) Frequency of longitudinal vibration
   ii) Frequency of torsional vibration
   iii) Frequency of transverse vibration. **(15 Marks)**

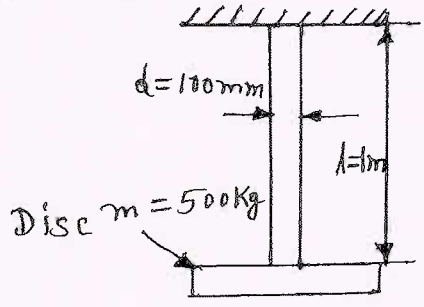


Fig.Q.8(b)

Module-5

9 a. Derive an expression for logarithmic decrement for an under damped case. **(10 Marks)**

b. Determine:
   i) Critical damping coefficient
   ii) Damping factor
   iii) Natural frequency of damped vibrations
   iv) Logarithmic decrement
   v) Ratio of two consecutive amplitudes of a vibrating system which consists of a mass of 25kg, a spring of stiffness 15kN/m and a damper. The damping provided is only 15% of the critical value. **(10 Marks)**

OR

10 a. Derive for transmissibility ratio due to harmonic excitation. **(10 Marks)**

b. A mass of 100kg been mounted a spring dashpot system having spring stiffness of 19,600N/m and damping coefficient of 100N-s/m. The mass is acted upon by a harmonic force of 39N at the undamped natural frequency of the system. Determine:
   i) Amplitude of vibration of the mass.
   ii) Phase difference between the force and displacement.
   iii) Forced transmissibility ratio. **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

17ME53

Fifth Semester B.E. Degree Examination, Aug./Sept. 2020
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. Define a turbo machine. List any six differences between turbo machines and positive displacement machines. **(08 Marks)**

b. Identify the following as power generating or power absorbing turbo machines:
(i) Centrifugal compressor (ii) Steam turbine
(iii) Air blower (iv) Kaplan turbine. **(04 Marks)**

c. Tests on a turbine runner 1.25 m in diameter at 30 m head gave the following results : Power developed = 736 kW, Speed = 180 rpm, 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 the specific speed of both turbines? **(08 Marks)**

OR

2 a. Define the following for an expansion process:
(i) Total-to-Total efficiency (ii) Total-to-static efficiency. **(04 Marks)**

b. Show that the polytropic efficiency for a compression process is given by $\eta_P = \frac{n}{n-1} \times \frac{r-1}{r}$ where r is the ratio of specific heats, n is the index of compression. **(08 Marks)**

c. Air flows through an air turbine where its stagnation pressure is decreased in the ratio 5 : 1. Total-to-Total efficiency is 0.8. The air flow rate is 5 kg/s. If the total power output is 500 kW, find : (i) Inlet total temperature (ii) Actual exit static temperature if the flow velocity is 100 m/s. (iii) Actual exit total temperature (iv) Total-to-static efficiency. **(08 Marks)**

Module-2

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

b. At a stage in a 50% degree of reaction axial flow turbine running at 3000 rpm, the blade mean diameter is 68.5 cm. If the maximum utilization factor for the stage is 0.915, calculate the inlet and outlet absolute velocities for the rotor. Find also the power output for a flow rate of 15 kg/s. **(10 Marks)**

OR

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

b. In a mixed flow compressor handling air at 16000 rpm, the stagnation temperature of air at compressor inlet and outlet are respectively 27°C and 215°C. The absolute velocity of air at rotor inlet is axial while at the exit, the tangential component of absolute velocity is 0.93 times the tangential impeller speed. If the mass flow rate is 15 kg/s, find the impeller diameter and total power input. **(10 Marks)**

Module-3

5 a. Derive the condition for maximum blade efficiency of a single stage impulse steam turbine. For symmetric blades with no friction in the blade channels, further show that $(\eta_{rotor})_{max} = \cos^2 \alpha_1$ where α_1 = nozzle angle at inlet. **(10 Marks)**

b. For a De-Laval turbine, the following data are given –
Jet velocity of steam = 450 m/s, Nozzle angle = 25°, Moving blade exit angle = 20°, Blade speed = 180 m/s, Mass of steam = 2 kg/s, velocity coefficient of blades = 0.8. Determine with velocity triangles : (i) Power developed (ii) axial thrust (iii) blade efficiency **(10 Marks)**

OR

6 a. What do you mean by compounding of steam turbine? Explain with the help of schematic diagram, the following methods of compounding :
(i) Velocity compounding (ii) Pressure compounding. **(10 Marks)**

b. The following particulars refer to a Parson's reaction turbine :
Mean diameter of the blade ring = 90 cm, Speed = 3000 rpm,
Inlet absolute velocity = 350 m/s, Blade outlet angle = 20°,
Steam flow rate = 7.2 kg/s. Calculate :- (i) Blade inlet angle (ii) Tangential force (iii) Power developed. **(10 Marks)**

Module-4

7 a. Define the following heads of hydraulic turbine : (i) Gross head (i) Net head. **(04 Marks)**

b. Define the following efficiencies of hydraulic turbine :
(i) Hydraulic efficiency (ii) Mechanical efficiency (iii) Overall efficiency **(06 Marks)**

c. A double jet Pelton wheel is required to generate 7500 kW when the available head at the base of the nozzle is 400 m. 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 each jet (ii) Total flow rate (iii) Tangential force on the buckets. Assume overall efficiency = 80%, Speed ratio = 0.47, $C_v = 0.97$ **(10 Marks)**

OR

8 a. Draw a neat sketch of Francis turbine and explain the functions of main parts. Draw the velocity triangles of a Francis turbine. **(10 Marks)**

b. The following data is given for a Francis turbine : Net head = 70 m, Speed = 600 rpm, Shaft power = 368 kW, Overall efficiency = 85%, Hydraulic efficiency = 95%, Flew ratio = 0.25, Breadth ratio = 0.1, Outer diameter of the runner = 2 × inner diameter of the runner. Velocity of flow is constant throughout. The thickness of the vanes occupies 10% of the circumferential area of the runner and discharge is radial at outlet. Determine :
(i) Guide blade angle (ii) Runner vane angles at inlet and outlet
(iii) Diameter of the runner at inlet and outlet (iv) Width of the runner at inlet. **(10 Marks)**

Module-5

9 a. What is cavitation in centrifugal pumps? What are the effects of cavitation? **(04 Marks)**

b. Derive an expression for static pressure rise in the impeller of a centrifugal pump with velocity triangles. **(08 Marks)**

c. A 4 stage centrifugal pump has impellers each 38 cm diameter and 1.9 cm wide at outlet. The outlet vane angle is 45° and the vanes occupy 8% of outlet area. The manometric efficiency is 84% and overall efficiency is 75%. Determine the head generated by the pump when running at 900 rpm and discharging 0.059 kg/s. Also find the shaft power. **(08 Marks)**

OR

10 a. Derive an expression for overall pressure ratio for a centrifugal compressor in terms of impeller tip speed, slip, power input factor and isentropic efficiency of compressor. **(10 Marks)**

b. An axial flow compressor has the following data:
Entry condition = 1 bar, 20°C, Degree of reaction = 50%,
Mean blade ring diameter = 36 cm, Blade height at entry = 6 cm,
Rotational speed = 18000 rpm, Blade angle at rotor exit = 65°,
Axial velocity = 180 m/s, Mechanical efficiency = 0.967.
Calculate : (i) Blade angle at rotor inlet (ii) Power required to drive the compressor. **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

17ME54

Fifth Semester B.E. Degree Examination, Aug./Sept.2020
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. Any missing data may be suitably assumed.
3. Use of design data hand book is permitted.

Module-1

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

b. What is stress concentration? Mention the reasons for stress concentration. **(04 Marks)**

c. A C-clamp shown in Fig.Q1(c) carries a load of 25 kN. The cross-section of the clamp is rectangular and the ratio of depth to width (d/b) is 2:1. The clamp is made of cast steel of grade 20-40 (σ_y = 400 N/mm^2) and the factor of safety is 4. Determine the dimension of the cross section of the clamp.

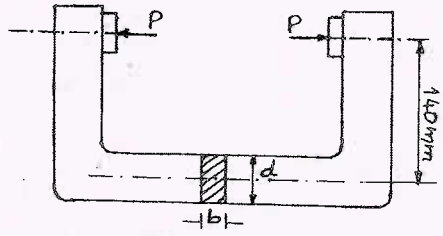


Fig.Q1(c) **(10 Marks)**

OR

2 a. Define factor of safety. **(02 Marks)**

b. Mention the principal theories of elastic failures and explain any two. **(08 Marks)**

c. A flat plate as shown in Fig.Q2(c) is subjected to a tensile force of 10 kN. The plate material is grey cast iron FG200 (σ_u = 200 N/mm^2) and factor of safety is 2.5. Determine the thickness of the plate.

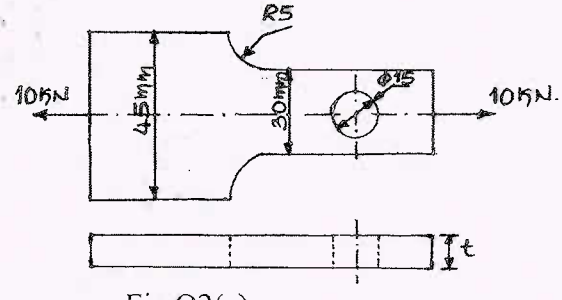


Fig.Q2(c) **(10 Marks)**

Module-2

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

b. Define the following :
(i) Fatigue load (ii) Range of stress
(iii) Amplitude ratio (iv) Endurance Limit **(04 Marks)**

c. A weight of 1 kN is dropped from a height of 50 mm at the free end of a cantilever beam of effective length of 800 mm, selecting C40 steel (σ_y = 324 N/mm^2) and factor of safety 3. Determine (i) Cross-section of the cantilever beam of square cross-section (ii) Impact factor. Assume modulus of elasticity as 200 GPa. **(10 Marks)**

OR

4 a. Explain the factors affecting endurance limit. **(08 Marks)**

b. A steel shaft is subjected to a bending moment varies from 100 N-m to 200 N-m and transmit 10 kW at 150 rpm. The torque varies over a range of ±40%. The shaft is made of steel whose yield stress is 400 N/mm^2 and endurance stress 300 N/mm^2. Surface coefficient factor 0.9, size factor 1.2, factor of safety 5, stress concentration factor 1.94. Determine the diameter of shaft for infinite life. **(12 Marks)**

Module-3

5 A horizontal commercial shaft is supported by two bearings 1.5m apart. A keyed gear 20° involute and 175mm diameter is located 400mm to the left of the right bearing and is driven by a gear directly behind it. A 600mm diameter pulley is keyed to the shaft 600mm to the right of the left bearing and drives a pulley with a horizontal belt drive directly behind it. The ratio of tension of the belt is 3:1, with the slack side on top. The drive transmit 45 kW at 330 rpm. Take $C_m(k_b) = C_t(k_t) = 1.5$. Calculate the necessary diameter of the shaft. Use allowable shear stress of 40 MPa **(20 Marks)**

OR

6 a. What is Cotter? Mention the different types of Cotter Joint. **(04 Marks)**

b. Design a square key for fixing a gear on a shaft of 25mm diameter. The shaft is transmitting 15 kW power at 720 rpm to the gear. The key is made of steel 50C4 (σ_y = 460 N/mm^2) and the factor of safety is 3. For key material, the yield strength in compression can be assumed to be equal to the yield strength in tension. Determine the dimension of the key. **(06 Marks)**

c. Design a rigid type of flange coupling to connect two shafts. The input shaft transmit 37.5 kW power at 180 rpm to the output shaft through the coupling. The design torque is 1.5 times rated torque. The shaft and keys are made of steel with yield strength of 380 N/mm^2 with factor of safety 2.5. flanges are made of grey cast iron FG200 with factor of safety 6. Assume ultimate shear strength is one half of the ultimate tensile strength. **(10 Marks)**

Module-4

7 a. Design a triple riveted lap joint zig-zag type, for a pressure vessel of 1.5m diameter. The maximum pressure inside the vessel is 1.5 MPa. The allowable stresses in tension, crushing and shear are 100 MPa, 125 MPa and 75 MPa respectively. **(10 Marks)**

b. Determine the size of the weld required for an eccentrically loaded weld as shown in Fig.Q7(b). The allowable stress in the weld is 75 N/mm^2.

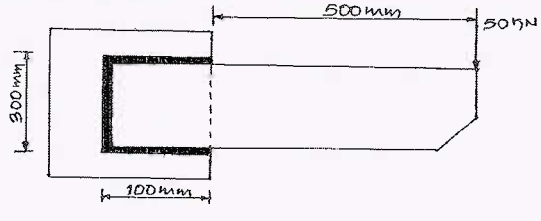


Fig.Q7(b) **(10 Marks)**

OR

8 a. A tie bar bridge consists of a flat 350 mm wide and 20 mm thick. Design an economical double cover butt joint if the permissible stresses are σ_t = 90 N/mm^2, σ_c = 150 N/mm^2 and τ = 60 N/mm^2. **(16 Marks)**

b. Two plates are joined by means of fillet weld as shown in Fig.Q8(b). The leg dimension of the weld is 10mm and the permissible shear at the throat cross-section is 75 N/mm^2. Determine the length of each weld. **(04 Marks)**

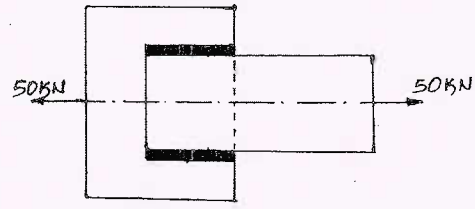


Fig.Q8(b)

Module-5

9 a. The base of a Pillar crane is fastened to the foundation by 8 bolts spaced equally on bolt circle diameter 1.6m. The diameter of the pillar base is 2m. Determine the size of bolt when crane carries a load of 100 kN at a distance of 5m from the centre of the base as shown in Fig.Q9(a). The allowable stress for the bolt material is 100 MPa.

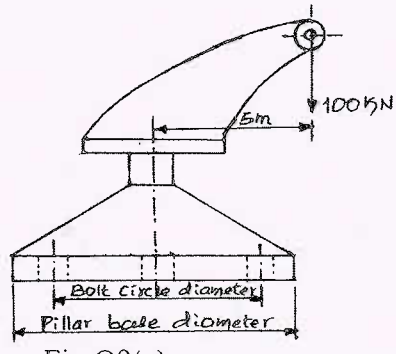


Fig.Q9(a) **(05 Marks)**

b. The square thread of a screw jack with a specification of 80×16, with a double start is to raise a load of 100 kN. The mean collar diameter is 130mm. The coefficient of friction for the threads and the collar are 0.1 and 0.12 respectively. Determine
(i) Torque required to raise the load.
(ii) Torque required to lower the load
(iii) Efficiency of the screw.
(iv) Check for overhaul. **(15 Marks)**

OR

10 a. Explain self locking and overhauling in power screw. **(04 Marks)**

b. Obtain the expression the torque required to lift the load in a square threaded screw. **(06 Marks)**

c. The joint shown in Fig.Q10(c) is subjected to an eccentric load of 40 kN. The bolts are made of plain carbon steel having yield strength in tension of 400 MPa and the factor of safety is 2.5. Determine size of bolts.

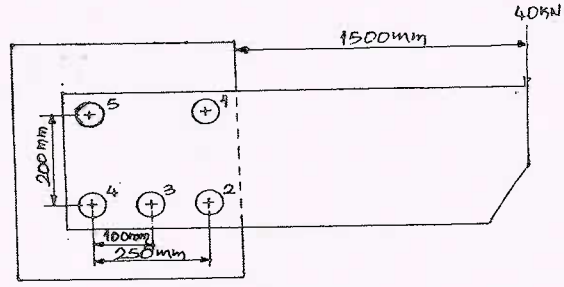


Fig.Q10(c) **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

17ME554

Fifth Semester B.E. Degree Examination, Aug./Sept. 2020
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. Discuss briefly the classification of Non-Traditional Machining process based on different sources of energy. **(08 Marks)**

b. Explain the need for Non-Traditional Machining process. **(06 Marks)**

c. List any 3 advantages and limitation of NTM. **(06 Marks)**

OR

2 a. Explain various parameters to be considered for selecting modern machining processes. **(08 Marks)**

b. Differentiate between traditional and Non-Traditional Machining process. **(06 Marks)**

c. List the applications of NTM. **(06 Marks)**

Module-2

3 a. Explain with graph the effect of various process parameters on Material Removal Rate in USM process. **(10 Marks)**

b. Explain with a neat sketch the principle, equipment and operation of USM process. **(08 Marks)**

c. List the advantages of Water Jet Machining processes. **(02 Marks)**

OR

4 a. Explain various process variables that influence the MRR in Abrasive Jet Machining process. **(10 Marks)**

b. Explain with neat sketch, water jet machining process. **(08 Marks)**

c. List any 4 applications of USM process. **(02 Marks)**

Module-3

5 a. Explain various process characteristics in ECM. **(06 Marks)**

b. Explain with neat sketch, Electro Chemical Honing Process. **(08 Marks)**

c. Explain in brief about Echants, and list the factors to be considered in selecting an echants. **(06 Marks)**

OR

6 a. Explain with neat sketch the sequence of operation in chemical milling using cut and peel maskant. **(08 Marks)**

b. Explain the process characteristics of Chemical Machining Process. **(06 Marks)**

c. List any 6 applications of ECM process. **(06 Marks)**

Module-4

7 a. Explain the mechanism of metal removal in Electro Discharge Machining (EDM). **(06 Marks)**

b. Explain dielectric medium, its function and desirable properties in EDM process. **(10 Marks)**

c. Explain in brief the 2 modes of operation of DC plasma torches. **(04 Marks)**

OR

8 a. Explain Non-Thermal generation of plasma with a neat sketch and mechanism of metal removal. **(10 Marks)**

b. Explain briefly plasma arc surfacing and spraying. **(06 Marks)**

c. Explain with sample sketch Heat Affected Zone (HAZ) in EDM showing all the 3 regions. **(04 Marks)**

Module-5

9 a. Explain with neat sketch Electron Beam Machining Process (EBM). **(10 Marks)**

b. Explain in brief machining of metal removal in EBM. **(04 Marks)**

c. List the advantages, limitations and application of Laser Beam Machining (LBM) **(06 Marks)**

OR

10 a. Explain with simple sketch principle of generation of Laser. **(06 Marks)**

b. Explain with neat sketch Laser Beam Machining Process. **(10 Marks)**

c. List the advantages and limitation of Electron Beam Machining (EBM). **(04 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

17ME564

Fifth Semester B.E. Degree Examination, Aug./Sept.2020
Project Management

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define Project. Explain characteristics of Project Management. **(10 Marks)**
b. List and explain briefly various types of projects. **(10 Marks)**

OR

2 a. How does scalability of project tools affect organization? **(10 Marks)**
b. Define strategic planning process and explain tools used in strategic planning analysis. **(10 Marks)**

Module-2

3 a. Define work Breakdown structure. Explain the steps in WBS construction. **(10 Marks)**
b. Define project scope. Explain the steps used in setting up the WBS. **(10 Marks)**

OR

4 a. Explain how the project schedules are limited and created. **(10 Marks)**
b. What are the purposes of a project schedule and also explain Ganttchart? **(10 Marks)**

Module-3

5 a. Explain the issues in project team composition when selecting team members. **(10 Marks)**
b. List and explain the methods of estimating costs. **(10 Marks)**

OR

6 a. Explain the strategies for responding to risks. **(10 Marks)**
b. List and describe frequency used project quality tools. **(10 Marks)**

Module-4

7 a. Define project supply chain management and explain with a flow diagram explain project supply chain management. **(10 Marks)**
b. Explain planning purchases, acquisition and planning contracting. **(10 Marks)**

OR

8 a. How do you implement a balanced score card for a customer? **(10 Marks)**
b. Explain briefly perform administrative and contract closure. **(10 Marks)**

Module-5

9 a. Explain the basic steps involved in PERT/CPM techniques. **(10 Marks)**

b. Explain Fulkerson's AOA and AON rules with example and explain the parameters helps in crashing (any five). **(10 Marks)**

OR

10 The following table shows the jobs of a network along with their time estimates:

Job	1-2	1-6	2-3	2-4	3-5	4-5	6-7	5-8	7-8
t_o	1	2	2	2	7	5	5	3	8
t_m	7	5	14	5	10	5	8	3	17
t_p	13	14	26	8	19	17	29	9	32

Draw the project network and find the probability that the project is completed in 40 days.

(20 Marks)

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

15ME51

Fifth Semester B.E. Degree Examination, Aug./Sept.2020
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 table is permitted.

Module-1

1 a. Define Management. Explain functional areas of management. **(08 Marks)**
b. Describe briefly role of Management. **(08 Marks)**

OR

2 a. Define planning and explain nature of planning. **(08 Marks)**
b. Describe steps in planning and planning premises. **(08 Marks)**

Module-2

3 a. List the different types of organizations and explain briefly Functional organization, Line and Staff organization. **(08 Marks)**
b. Describe briefly processes of selection for recruitment. **(08 Marks)**

OR

4 a. List and explain different leadership styles. **(08 Marks)**
b. Describe briefly steps in controlling process. **(08 Marks)**

Module-3

5 a. Explain Problem Solving and Decision Making. **(05 Marks)**
b. Explain law of returns. **(05 Marks)**
c. A product has a demand of 3000 units when priced at Rs.100/unit. When the price is reduced at Rs.80/unit the sales increases to 3800 units.
(i) Find whether the demand is elastic or inelastic.
(ii) At what quantity of sales can the demand be called elastic or inelastic? **(06 Marks)**

OR

6 a. A person takes a loan of Rs.10,000 from a bank of interest of 10% P.A. Find the amount if
(i) Interest is compounded annually
(ii) Interest is compounded half yearly
(iii) Interest is compounded quantity
(iv) Interest is compounded monthly. **(08 Marks)**
b. Explain cash flow diagram lender point of view and borrow point of view. **(04 Marks)**
c. If a person deposited Rs. 25000 into a saving account that earn 12% per year, what uniform annual amount could be withdrawn at the end of each fear for 10 years. **(04 Marks)**

Module-4

7 a. Explain briefly conditions for present worth comparison **(06 Marks)**

b. Company is evaluating three robots for possible use in its assembly operating data associated with robots are as follow:

Particulars	Robot A	Robot B	Robot C
First Costs (Rs.)	55000	58000	53000
Operating and maintenance costs (Rs.)	3000/year	4500/year	4000/year
Expected incomes (Rs.)	44000/year	44000/year	38000/year
Expected salvage value (Rs.)	4000	6000	4000

All values in rupees. Assuming a technological life of 3 years and a desired interest rate of 12% which robot seems to be preferable assuming all other factors are equal? Use net present worth evaluation. **(10 Marks)**

OR

8 a. A plot can be purchased for Rs. 13,80,000 company A offers a loan at 7.5% nominal interest to be compounded monthly. If a down payment of Rs. 25,000 is paid initially. The loan is to be paid off in 15 years. Company B offers 20 years repayment period with the same down payment but the nominal interest rate is 9% compounded monthly. Evaluate the monthly payment for the above two alternatives. **(10 Marks)**

b. Briefly explain Minimum Acceptable Rate of Return (MARR), IRR, ERR. **(06 Marks)**

Module-5

9 a. Explain how selling price of components / Products are fixed. **(06 Marks)**

b. A small firm is producing 100 pens per day. The direct material cost is found to be Rs. 160. Direct labour cost Rs. 200 and factory overheads chargeable to it Rs. 250. If the selling on cost is 40% of the factory cost. What must be the selling price of each pen to realize a profit of 14.6% of the selling price. **(05 Marks)**

c. An article can be made either by hand or in large quantity by mass production. If the former case, time taken is 3 hrs and overheads are 25% of labour cost, while in the later case time takes for 10 pieces is 8 hours but overheads are 150% of labour cost. Material cost is Rs. 1.50/piece and labour charges are Rs.0.80/hr. Compare the total cost in both the cases. **(05 Marks)**

OR

10 a. What is depreciation explain the causes of depreciation. **(06 Marks)**

b. A lathe is purchased for Rs.8,00,000 and assumed life is 10 years and scrap value is Rs.2,00,000. If the depreciation is charged by (i) Diminishing balance method – Depreciation fund after 2 years. (ii) Straight line method of depreciation (iii) SOYD method – for 4 years. **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

15ME52

Fifth Semester B.E. Degree Examination, Aug./Sept. 2020
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 conditions for static equilibrium of a body subjected to a system of, (i) two forces (ii) Three forces. **(04 Marks)**

b. For the static equilibrium of the quick return mechanism shown in Fig. Q1 (b). Find the required input torque T_2 for a force of 3500 N on the slider. Angle of EB with the vertical is 70°. The impending motion of the slider is to the lift. **(12 Marks)**

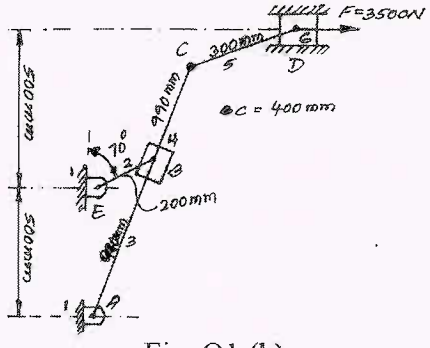


Fig. Q1 (b)

OR

2 a. What do you mean by inertia force and inertia torque? **(04 Marks)**

b. A four bar mechanism shown in Fig. Q2 (b) has the following length of various links O_2O_4 = 800 mm, O_2B = 330 mm, BC = 500 mm, O_4C = 400 mm, O_2G_2 = 200 mm, BG_3 = 250 mm, O_4G_4 = 200 mm. The masses of links are m_2 = 2.2 kg, m_3 = 2.5 kg, m_4 = 2 kg. The moment of inertia of links about their C.G are I_2 = 0.05 kg-m^2, I_3 = 0.07 kg-m^2. The crank O_2B rotates at 100 rad/s^2. Neglecting gravity effects, determine the forces in the joints and the input torque. **(12 Marks)**

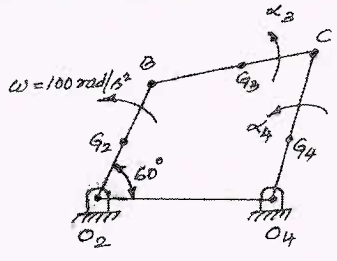


Fig. Q2 (b)

Module-2

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

b. A rotating shaft carries 4 masses A, B, C and D at radii 100, 125, 200 & 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the masses B, C and D having 10, 5 and 4 kg respectively. Find the required mass A and relative angular positions of 4 masses to keep the shaft in balance. **(12 Marks)**

OR

4 The cranks and connecting roads of a 4-cylinder in line engine running at 1800 rpm are 60 mm and 240 mm. Each respectively and the cylinder are spaced 150 mm apart. If the cylinders are numbered 1 to 4 in sequence from one end, the cranks appear at intervals of 90° in an End view in the order 1 – 4 – 2 – 3. The reciprocating mass corresponding to each cylinder is 1.5 kg. Determine
(i) Unbalanced primary and secondary force.
(ii) Unbalanced primary and secondary couples with reference to control plane of the engine. **(16 Marks)**

Module-3

5 a. Define the following: (i) Sensitiveness (ii) Hunting (iii) Isochronism (iv) Effort of governor (v) Stability of governor (vi) Power of governor. **(06 Marks)**

b. A loaded governor of the porter type has equal arms and links each 300 mm long. The weights of each ball is 20 N and the central weight is 120 N. When the ball radius is 150 mm, the valve is fully open and when the radius is 180 mm, the value is closed. Find the maximum speed and the range of speed. If the maximum speed is to be increased 25% by an addition of weight to the central load, find its valve. **(10 Marks)**

OR

6 a. Derive an expression for the gyroscopic couple $C = IWW_P$ from first principle. **(06 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 M.I. of 32 kg-m^2. Each wheel is of 450 mm radius. The centric distance between two wheel 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 of 16 kg-m^2 and rotates in the opposite direction to that of axle. The centre of mass of the car is 1 m above the rails. Calculate the limiting speed of the car when it has to travel around curve of 250 m radius without the wheels leaving the rails. **(10 Marks)**

Module-4

7 a. Define vibration. Give the classification of vibration. **(05 Marks)**

b. Add the following harmonic motions and check the solution graphically $x_1 = 2\cos(wt + 0.5)$, $x_2 = 5\sin(wt + 1.0)$. **(11 Marks)**

OR

8 a. Determine the natural frequency of the spring mass system considering mass of the spring. **(08 Marks)**

b. Find the natural frequency of the system as shown in Fig. Q8 (b). Solve by energy method. **(08 Marks)**

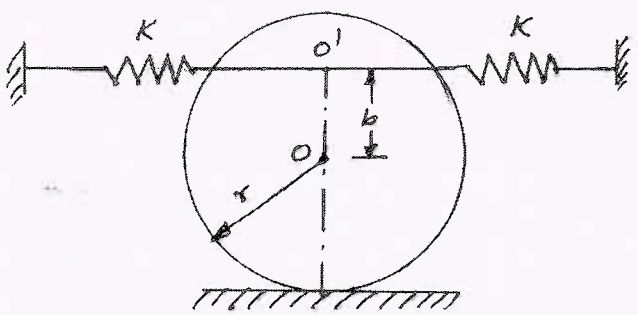


Fig. Q8 (b)

Module-5

9 a. Define damping. Explain different types of damping with neat sketches. **(10 Marks)**

b. Show that the ratio of successive amplitudes of mass in a under damped, viscously damped spring mass system is given by $\frac{x_0}{x_1} = e^{\delta}$ where $\delta = \frac{2\pi\xi}{\sqrt{1-\xi^2}}$. **(06 Marks)**

OR

10 a. Write a note on vibration isolation and transmissibility. Explain the influence of frequency ratio on transmissibility. **(08 Marks)**

b. A weight of 60 N suspended by a spring of stiffness 1.2 kN/m is forced to vibrate by a harmonic force of 10 N. Assuming viscous damping of 0.086 kN-s/m. Determine

(i) The resonant frequency.
(ii) Amplitude at resonance.
(iii) Phase angle at resonance.
(iv) Frequency corresponding to peak amplitude.
(v) Peak amplitude. **(08 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

15ME53

Fifth Semester B.E. Degree Examination, Aug./Sept.2020
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. Define Turbomachine. With a neat sketch, explain the parts of Turbomachine. **(04 Marks)**

b. Define specific speed of a pump. Obtain an expression for the same in terms of Discharge, Speed and head. **(06 Marks)**

c. Test on a Turbine Runner 1.25m in diameter at 30m head gives the following result, power developed 736kW, speed 180rpm, Discharge 2.7m/s. Find the Diameter, Speed and Discharge of a Runner to operate at 45m head and gives 1472kW power at same efficiency. **(06 Marks)**

OR

2 a. Derive an expression for polytropic efficiency of a compression process Interms of pressure and temperature ratio. **(06 Marks)**

b. A 16 stage Axial flow compressor is to have a pressure ratio of 6.3 and test have shown that a stage efficiency of 89.5% can be obtained. The Intake conditions are 288°K, 1 bar. Find:
i) Overall Efficiency
ii) Polytropic Efficiency
iii) Preheat factor. **(06 Marks)**

c. Explain static and stagnation state for a fluid. **(04 Marks)**

Module-2

3 a. Derive the alternate form of Euler's Turbine equation and state the significance of each components. **(08 Marks)**

b. As inward flow radial Vane Turbine has the following data: Power = 150kW, Speed = 32000rpm, Outer diameter of the Impeller = 20cm, Inner diameter of the Impeller = 8cm. Absolute velocity of gas at entry = 387m/s. Absolute velocity of gas at Exit = 193m/s and is Radial in direction, construct the velocity triangle at entry and exit of the Impeller and Determine:
i) Mass flow rate ii) Percentage energy transfer due to change of radius. **(08 Marks)**

OR

4 a. The total power Input at a stage in an axial flow compressor with symmetric inlet and outlet velocity triangle (R = 0.5) is 27.85kJ/kg of air flow. If the blade speed is 180m/s throughout the Rotor, Draw the velocity triangle and compute the inlet and outlet rotor blade angles. Assume axial velocity component to be 120m/s. **(08 Marks)**

b. The mean Rotor blade speed of an Axial flow turbine stage with 50% reaction is 210m/s. Steam emerges from the Nozzle inclined at 28° to the plane of the wheel with Axial component equal to blade speed. Assuming symmetric inlet and outlet velocity triangles. Determine the Rotor blade angle and utilization factor. Also determine the degree of reaction to make the utilization maximum if the axial velocity, blade speed as well as nozzle angle remain the same. **(08 Marks)**

Module-3

5 a. Define: i) Blade efficiency ii) Nozzle efficiency iii) Stage efficiency for impulse steam turbine. **(06 Marks)**

b. Derive an expression for condition for maximum efficiency of a reaction steam turbine. **(10 Marks)**

OR

6 a. In a 50% Reaction Turbine the blade speed is 65m/s dry steam at 1.5bar flows at 5kg/s the blade angles are 20° and 35°. Find: i) Blade height which is 1/10 diameter of the blade ring ii) Power developed iii) Heat drop if stage efficiency is 80%. **(08 Marks)**

b. In a Parsons Turbine the axial velocity of flow of steam is 0.5 times the mean blade speed. The outlet angle of the blade is 20°, the diameter of the blade ring is 1.3m and the Rotational speed is 3000rpm. Determine inlet blade angles, power developed for the steam flow of 65kg/s and the Isentropic Enthalpy drop if the stage efficiency is 80%. **(08 Marks)**

Module-4

7 a. Classify Hydraulic turbines with examples. **(04 Marks)**

b. With a neat sketch, explain Pelton Wheel Turbine. **(05 Marks)**

c. A Pelton Wheel is to be designed for the following specifications. Shaft power = 735kW, head = 200m, speed = 600rpm, overall efficiency = 0.75, the jet diameter not to exceed $1/10^{th}$ of the wheel diameter, $C_v = 0.958$, speed ratio = 0.5. Determine: i) Wheel diameter ii) Number of Jets required iii) Diameter of Jet. **(07 Marks)**

OR

8 a. A Kaplan Turbine has an outer diameter of 8m and inner diameter as 3m and developing 30.000kW at 80rpm under a head of 12m. The discharge through the runner is $300m^3/sec$ if Hydraulic Efficiency is 95%. Determine Inlet and Outlet blade angles, Mechanical Efficiency, Overall Efficiency. **(08 Marks)**

b. A Francis Turbine has wheel diameter of 1m at the entrance and 0.5m at the exit. The guide vane angle is 15°. The water at exit leaves the vane without any Tangential component. The vane angle at the entrance is 90°. The head is 30m and the radial component of the flow is constant. What would be the speed of the wheel in rpm and vane angle at exit? **(08 Marks)**

Module-5

9 a. What is meant by cavitation in centrifugal pumps? What are the causes of cavitation? **(08 Marks)**

b. The outer diameter of the Impeller of a centrifugal pump is 40cm and width of the impeller at outlet is 5cm. The pump is Running at 800rpm and working against a total head of 15m. The vane angle at outlet is 40° and Manometric efficiency is 75%. Determine: i) Velocity of flow at outlet ii) Velocity of water leaving the vane iii) Angle made by the absolute velocity at outlet iv) Discharge. **(08 Marks)**

OR

10 a. Define the following terms of centrifugal compressor:
i) Overall pressure ratio ii) Pressure co-efficient iii) Slip factor iv) Power factor. **(08 Marks)**

b. An Axial flow compressor with 50%. Reaction is having a flow coefficient with 0.54. Air enters the compressor at stagnation condition of 1 bar and 30°C. The total-to-total efficiency across the rotor is 0.88 pressure coefficient is 0.45 and the workdone factor is 0.88. The Total-to-total pressure ratio across the rotor is 1.26. Mass flow rate is 15kg/sec. Calculate: i) Mean rotor blade speed ii) Rotor angles at inlet and exit iii) Power Input to the system **(08 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

15ME54

Fifth Semester B.E. Degree Examination, Aug./Sept.2020
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. Draw the stress strain diagram for a ductile material and briefly explain the salient points. **(06 Marks)**

b. What are the factors to be considered for the selection of material for a machine component? **(06 Marks)**

c. Explain the codes and standards used in machine design. **(04 Marks)**

OR

2 a. Define stress concentration. Briefly explain the factors effecting stress concentration. **(06 Marks)**

b. A round rod of diameter 1.2d has semicircular groove of diameter 0.2d. The rod is subjected to a bending moment of 10 kN-m. The material of the rod is C30 steel (σ_y = 294 N/mm^2). Determine the safe value of 'd'. If the factor of safety = 2. **(10 Marks)**

Module-2

3 a. Derive an expression for instantaneous stress due to axial impact. **(06 Marks)**

b. A cantilever beam of width 50 mm, depth 150 mm is 1.5m long. It is struck by a weight of 1000 N that falls from a height of 10 mm at its free end. Determine impact factor, instantaneous maximum deflection, instantaneous maximum stress, instantaneous maximum load. Take E = 206 GPa. **(10 Marks)**

OR

4 A steel cantilever member shown in Fig.Q4 is subjected to a transverse load at its end that varies from 45N (up) to 135N (down) and axial load varies from 110 N (compression) to 450 N (tension). Determine the required diameter at the change of section for infinite life using a factor of safety 2. The strength properties of the material are σ_u = 550 MPa, σ_y = 470 MPa, σ_{-1} = 275 MPa, notch sensitivity index, q = 1.

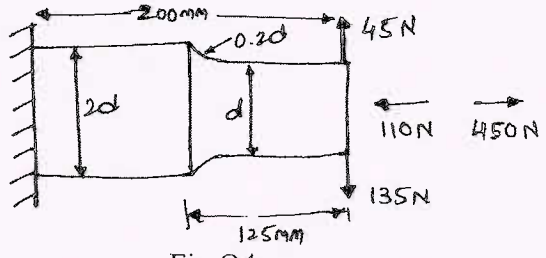


Fig.Q4 **(16 Marks)**

Module-3

5 A mild steel shaft transmits 20 KW at 200 rpm. It carries a central load of 900 N and is simply supported between the bearings 2.5 m apart. Determine the size of the shaft, if the allowable shear stress is 42 MPa and the maximum tensile or compressive stress is not to exceed 56 MPa. What size of the shaft will be required, if it is subjected to gradually applied loads? **(16 Marks)**

OR

6 a. Design a knuckle joint to connect two circular rods subjected to an axial tensile force of 50 kN. The rods are co-axial and a small amount of angular movement between their axes is permissible. The design stresses may be taken as 80 N/mm^2 in tension, 40 N/mm^2 in shear and 80 N/mm^2 in compression. **(08 Marks)**

b. Design a flange coupling to connect the shaft of a motor and centrifugal pump for the following specifications: pump output = 3000 liters/minute, total head = 20 m, pump speed = 600 rpm, pump efficiency = 70%. Select C40 steel (σy = 328.6 MPa) for shaft and C35 steel (σ_y = 304 MPa) for bolts with factor of safety 2. Use allowable shear stress in cast iron flanges equal to 15 N/mm^2. **(08 Marks)**

Module-4

7 a. Briefly explain the types of failure in riveted joints. **(04 Marks)**

b. Design a double riveted butt joint with two cover plates for longitudinal beam of a boiler shell 1.5 m in diameter subjected to steam pressure of 0.95 N/mm^2. Assume joint efficiency as 75%, allowable tensile stress is 90 N/mm^2, crushing stress is 140 N/mm^2 and shear stress is 56 N/mm^2. **(12 Marks)**

OR

8 a. A solid circular shaft 25 mm in diameter is welded to a support by means of a fillet weld as shown in Fig.Q8(a). Determine the leg dimensions of the weld if the permissible shear stress is 95 N/mm^2.

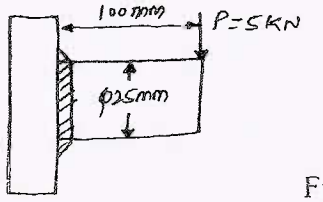


Fig.Q8(a) **(06 Marks)**

b. A bracket is welded to a side column as shown in Fig.Q8(b) with a permissible stress of 80 N/mm^2. Determine the maximum load that the bracket can withstand if the size of the weld is 10 mm.

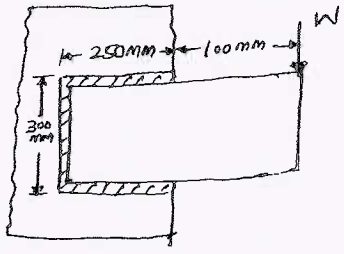


Fig.Q8(b) **(10 Marks)**

Module-5

9 a. Explain the various type of stresses in thread fasteners. **(06 Marks)**

b. A flat circular plate is used to close the flanged end of a pressure vessel of internal diameter 300 mm. The vessel carries a fluid at a pressure of 0.7 N/mm^2. A soft copper gasket is used to make the joint leak proof. Twelve 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 100 N/mm^2. **(10 Marks)**

OR

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

b. A machine slide weighing 20 kN is raised by a double start square threaded screw at the rate of 0.84 m/min. The coefficient of friction for screw and collar is 0.12 and 0.14 respectively. The outside diameter of the screw is 44 mm and pitch is 7 mm. The outside and inside diameters of the collar at the end of the screw are 58 mm and 32 mm respectively. Calculate the power required to drive the slide and efficiency. If the allowable shear stress in the screw is 30 MPa, is the screw strong enough to sustain the load. **(10 Marks)**

CBCS SCHEME

USN | | | | | | | | | | |

15ME61

Sixth Semester B.E. Degree Examination, Aug./Sept.2020
Finite Element Method

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain briefly about Node location system and numbering scheme. **(06 Marks)**

b. For the spring system shown in Fig.Q1(b), using principle of minimum potential energy, determine the nodal displacements. Take $F_1 = 75N$, $F_2 = 100N$.

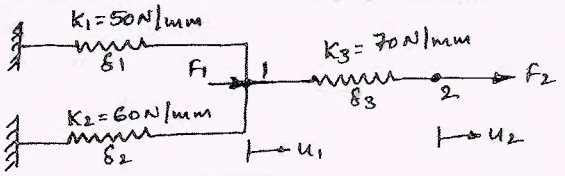


Fig.Q1(b) **(10 Marks)**

OR

2 a. State and explain convergence requirements. **(04 Marks)**

b. Write a short note on :

(i) Geometrical isotropy for 2D Pascal triangle.

(ii) Coordinate system. **(06 Marks)**

c. Explain simplex, complex and multiplex elements. **(06 Marks)**

Module-2

3 a. Derive the shape function for triangular (CST Element) in natural coordinate system. **(08 Marks)**

b. Derive the shape functions for a 4-node Quadrilateral element in natural co-ordinates. **(08 Marks)**

OR

4 a. Obtain an expression for stiffness matrix of a truss element. **(06 Marks)**

b. Find the nodal displacement, stress and reaction of truss element shown in Fig.Q4(b). Take E = 200 GPa.

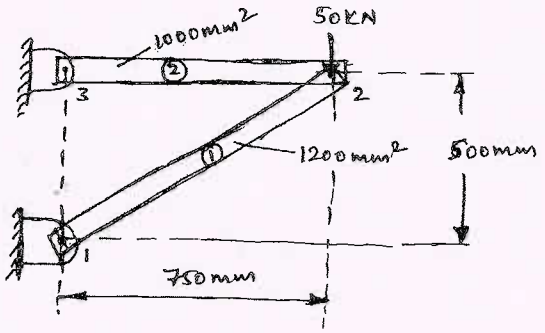


Fig.Q4(b) **(10 Marks)**

Module-3

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

b. For the beam and loading shown in Fig.Q5(a), determine the slopes at 2 and 3 and the vertical deflection at the midpoints of the distributed load. Take E = 200 GPa, $I = 4\times10^6 mm^4$.

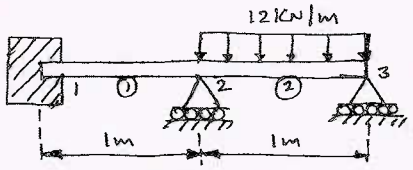


Fig.Q5(a) **(08 Marks)**

OR

6 a. Derive the stiffness matrix for a circular shaft subjected to pure torsion. **(08 Marks)**

b. A solid stepped bar of circular c/s shown in Fig.Q6(b) is subjected to a torque of 1 kN-m at its free end and torque of 3 kN-m at its change in c/s section. Determine the angle of twist and shear stress in the bar. Take $E = 2\times10^5 N/mm^2$, $G = 7\times10^4 N/mm^2$.

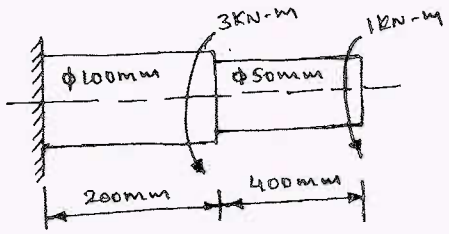


Fig.Q6(b) **(08 Marks)**

Module-4

7 a. Derive element conductivity matrix for 1-dimensional heat flow element. **(06 Marks)**

b. Determine the temperature distribution through the composite wall subjected to convection heat loss on the right side surface with convective heat transfer co-efficient as shown in Fig.Q7(b). The ambient temperature is – 5°C.

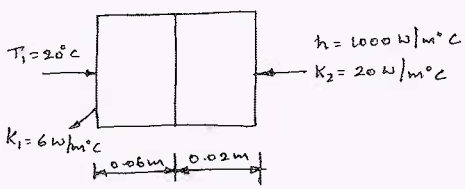


Fig.Q7(b) **(10 Marks)**

OR

8 a. Derive the stiffness matrix for 1D fluid element. **(08 Marks)**

b. For the smooth pipe shown in Fig.Q8(b), with uniform c/s of 1 m^2. Determine the flow velocities at the centre and right end, knowing the velocity at the left is $V_x = 2m/s$.

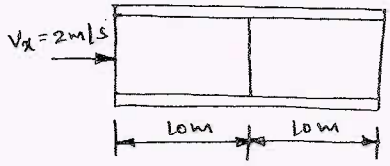


Fig.Q8(b) **(08 Marks)**

Module-5

9 a. Derive the shape function for an axisymmetric triangular element. **(08 Marks)**

b. For the element of an axisymmetric body rotating with a constant angular velocity ω = 1000 rev/min as shown in Fig.Q9(b), determine the body force vector. Include the weight of the material, where the specific density is 7850 kg/m^3.

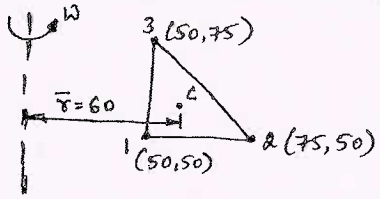


Fig.Q9(b) **(08 Marks)**

OR

10 a. Derive the consistent mass matrix for bar element. **(06 Marks)**

b. Determine the natural frequency of longitudinal vibration of the bar shown in Fig.Q10(b). Take, E = 200 GPa, ρ = 7840 kg/m^3, A = 240 mm^2.

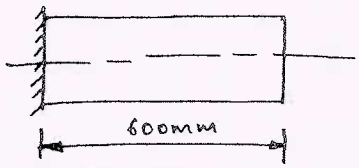


Fig.Q10(b) **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

15ME63

Sixth Semester B.E. Degree Examination, Aug./Sept.2020
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 and Mass Transfer data handbook is permitted.***

Module-1

1 a. Derive the 3-D heat conduction equation in Cartesian coordinate system for an isotropic material. Also write special forms of 3-D heat conduction equation. **(08 Marks)**

b. A furnace wall is made up of three layers of thickness 250 mm, 100 mm, 150 mm with thermal conductivities of 1.65, K, 9.2 W/m-K respectively. The inside is exposed to gases at 1250°C with convection coefficient of 25 W/m^2-K and outside surface is exposed to air at 25°C with convection coefficient of 12 W/m^2-K, inside surface is maintained at 1100°C. Determine:
(i) The unknown thermal conductivity
(ii) Overall heat transfer coefficient
(iii) All surface temperatures. **(08 Marks)**

OR

2 a. Explain the modes of heat transfer with corresponding governing laws. **(06 Marks)**

b. Explain the three kinds of boundary conditions to solve conduction problems. **(04 Marks)**

c. A wall of steam boiler furnace is made of layers of fire clay of thickness 12.5 cm ($K_1 = 0.28 + 0.00023T$ W/m°C) and red brick of 50 cm ($K_2 = 0.7$ W/m°C) where T is in °C. The inside surface temperature of fire clay is 1100°C and outside brick wall temperature is 50°C. Calculate the amount of heat loss per unit area of the furnace wall and the temperature at the interface. **(06 Marks)**

Module-2

3 a. What do you mean by critical thickness of insulation? Derive an expression for critical thickness of insulation for cylinder. **(05 Marks)**

b. In a thermal conductivity measuring experiment two identical long rods are used. One rod is made of aluminium (K = 200 W/m-K). The other rod is specimen. One end of both the rods is fixed to a wall at 100°C, while the other end is suspended in air at 25°C. The steady temperature at the same distance along the rods were measured and found to be 75°C on aluminium and 60°C on specimen rod. Find thermal conductivity of the specimen. Assume that the fin is insulated at the tip. **(05 Marks)**

c. Show that the temperature distribution under lumped analysis is given by, $\frac{T - T_\infty}{T_i - T_\infty} = e^{-Bi.Fo}$

where T_i is the initial temperature and T_∞ is the surrounding temperature. **(06 Marks)**

OR

4 a. What is the main purpose of fins? Define fin efficiency and fin effectiveness. **(04 Marks)**

b. What are Heisler charts? Explain their significance in solving transient conduction problems. **(04 Marks)**

c. A 12 mm diameter mild steel sphere at 540°C is exposed to cooling air flow at 27°C and heat transfer coefficient of 114 W/m2-K. Find:
   (i) The time required to cool the sphere from 540°C to 95°C
   (ii) Instantaneous heat transfer rate, two minutes after start of cooling
   (iii) Total heat transferred from the sphere during first two minutes.
   Properties of mild steel are: $\rho = 7850$ kg/m^3, C = 475 J/kg-K and $\alpha = 0.045$ m^2/hr. **(08 Marks)**

Module-3

5 a. Why numerical methods are preferred over analytical methods? List the numerical methods which are used in solving heat conduction problems. **(04 Marks)**

b. The boundary temperatures of a thin plate are as shown in Fig.Q5(b). Determine the temperature at the centre of the plate.

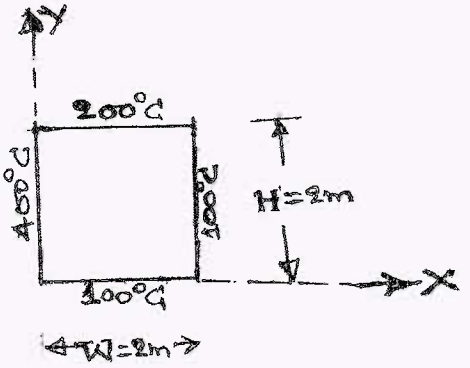


Fig.Q5(b) **(06 Marks)**

c. Explain:
   (i) Kirchhoff's law
   (ii) Plank's law
   (iii) Wien's displacement law **(06 Marks)**

OR

6 a. How is Laplace equation for 2D heat conduction approximated to the finite difference equations? **(08 Marks)**

b. Calculate the net radiant heat exchange per unit area for two large parallel plates at temperature of 427°C and 27°C respectively. Take emissivity of hot plate and cold plates are 0.9 and 0.6 respectively. If a polished aluminium shield is placed between them, find percentage reduction in the heat transfer. Take emissivity of shield as 0.4. **(08 Marks)**

Module-4

7 a. With the help of dimensional analysis obtain the fundamental relation between dimensionless numbers required for
   (i) Forced convection
   (ii) Natural convection. **(10 Marks)**

b. Water at a velocity of 1.5 m/s enters a 2 cm diameter heat exchanger tube at 40°C. The heat exchanger tube wall is maintained at a temperature of 100°C. If the water is heated to a temperature of 80°C in the heat exchanger tube, find the length of the exchanger tube required. **(06 Marks)**

OR

8 a. Define an explain the physical significance of the following dimensionless numbers:
(i) Grashoff number
(ii) Reynolds number **(04 Marks)**

b. For fluid flow over a flat plate, sketch (i) Velocity boundary layer (ii) Thermal boundary layer. Clearly mention salient points on the figure. **(04 Marks)**

c. A tube of 0.036 m OD and 40 cm length is maintained at a uniform temperature of 100°C. It is exposed to air at a uniform temperature of 20°C. Determine the rate of heat transfer from the surface of the tube when (i) the tube is vertical (ii) the tube is horizontal. **(08 Marks)**

Module-5

9 a. What is the importance of NTU effectiveness method? Derive an expression for the effectiveness of a parallel flow heat exchanger. **(08 Marks)**

b. Sketch pool boiling curve for water and explain the various regimes in boiling heat transfer. **(08 Marks)**

OR

10 a. List the assumptions made in Nusselt's theory of laminar film condensation on a plane vertical surface. **(04 Marks)**

b. Saturated steam at 80°C condenses as a film on a vertical plate at a temperature of 70°C. Calculate the average heat transfer coefficient and the rate of steam condensation per hour. Assume that the latent heat of vaporization at 80°C as 2309 kJ/kg. **(06 Marks)**

c. An oil cooler for a large diesel engine is to cool engine oil from 60 to 45°C using sea water at an inlet temperature of 20°C with a temperature rise of 15°C. The design load Q = 140 KW and the mean overall heat transfer coefficient based on the outer surface area of the tubes is 70 $W/m^2°C$. Calculate the heat transfer surface area for single pass counter flow and parallel flow arrangement. **(06 Marks)**

* * * * *

CBCS SCHEME

USN | 2 | V | D | 1 | 7 | M | E | 4 | 1 | 2 | 15ME64

Sixth Semester B.E. Degree Examination, Aug./Sept.2020
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. Write the difference between a straight and curved beam. **(06 Marks)**

b. The cross-section of a curved link is a symmetrical trapezium 50mm deep. The inner width and outer width are 50mm and 25mm respectively. Find the maximum stress when the link carries a load of 15 kN which passes through the centre of curvature of link. The internal radius of link as 50mm. **(10 Marks)**

OR

2 A tube with 50mm and 75mm as inner and outer diameter respectively, is reinforced by shrinking a jacket of outer diameter 10mm. The compound tube is to withstand an internal pressure of 35 MPa. The shrinkage allowance is such that the maximum tangential stress in each tube has same magnitude. Calculate shrinkage pressure and the original dimensions of the tube. Assume E = 207 kN/mm^2. **(16 Marks)**

Module-2

3 a. Explain the effect of slip, creep and centrifugal tension in flat belt drive. **(03 Marks)**

b. Specify he details of a V-belt drive for a 10 kW, 1160 rpm induction motor operating a fan at approximately 400 rpm. The centre distance between pulley is to be close to 1m, $\alpha = 34°$. **(13 Marks)**

OR

4 a. One helical spring is nested inside another; the dimensions are as tabulated. Both springs have the same free length and carry a total maximum load of 2500 N.

	Outer spring	Inner spring
No. of active coils	6	10
Wire diameter, mm	12.5	9.00
Mean coil diameter, mm	100	70

Determine : (i) The maximum load carried by each spring.
(ii) The total deflection of each spring
(iii)The maximum stress in two springs.
Take G = 83 GN/m^2. **(08 Marks)**

b. A truck spring has 12 numbers of leaves, two of which are full length leaves. The spring supports are 1.05 m apart and the central bond is 85mm wide. The central load is to be 5.4 kN with a permissible stress of 280 N/mm^2. Determine the thickness and width of the steel spring leaves. The ratio of the total depth to the width of the spring is 3. Also determine the deflection of the spring. Take = E = 0.26×10^6 MPa. **(08 Marks)**

Module-3

5 A pair of spur gear with 20° full depth teeth transmits 20 kW at 1500 rpm to the pinion. The speed reduction ratio is 4. Take material for pinion a gear having a permissible static stress of 220 N/mm^2 and 193.2 N/mm^2 respectively. You are required to check the design for dynamic load and prolonged wear. **(16 Marks)**

OR

6 Design a pair of bevel gears at acute angle to transmit 40 kW at 1200 rpm of the pinion with the velocity ratio of 6. Assume C-45 steel for both gears having permissible stress of 233.4 N/mm^2, BHN 200. Take number of teeths on pinion as 25. α = 14½ , θ = 45°. Consider continuous service of medium shocks. **(16 Marks)**

Module-4

7 Design a worm gear drive to transmit 5 kW at 1200 rpm. The speed ratio is to be 25 and the centre distance 250 mm. The worm wheel is made from phosphor bronze with permissible strength of 82.4 N/mm^2 and hardness 100 BHN, while the worm is made from steel 45 with permissible stress 233.4 N/mm^2 and 200 BHN. Load factor (k_l) = 1.25, α = 14.5°. **(16 Marks)**

OR

8 a. A differential bond brake shown in Fig.Q8(a) operates on a drum of diameter 600 mm. The bond is 3.2×100mm and coefficient of friction is 0.22. θ = 300°.

(i) Find the force required at the end of operating lever, when the bond is subjected to a stress of 55 N/mm^2.

(ii) Find the torque applied to the brake drum shaft.

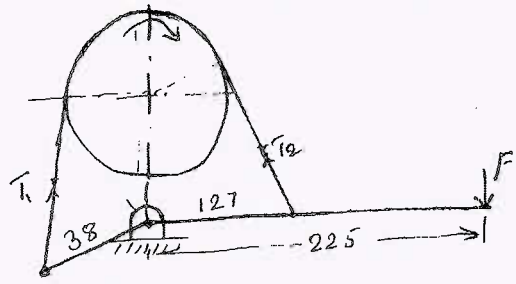


Fig.Q8(a) **(08 Marks)**

b. A cone clutch has a semi-cone angle of 12° to transmit 10 kW of 750 rpm. The width of the face is one fourth of the mean diameter of friction lining. The normal intensity of pressure between the contacting surface is not to exceed 0.85 N/mm^2. Assume uniform wear criterion. μ = 0.2. Calculate dimensions of clutch. Allowable shear stress for shaft material is 40 N/mm^2. **(08 Marks)**

Module-5

9 a. Derive Petroff's equation of lightly loaded bearing. **(08 Marks)**

b. A roller bearing has a dynamic load capacity of 26 kN. The desired life for 90% of the bearing is 8000 hr and the speed is 300 rpm. Calculate the equivalent radial load that the bearing can carry. **(08 Marks)**

OR

10 a. List the factors to be considered while selecting bearing material. **(06 Marks)**

b. A full bearing 200mm diameter by 200mm long supports a radial load 45 kN. The journal rotates at 1200 rpm and r/c = 1000. The viscosity of the oil at its operating temperature of 80°C is 0.1766 N/m^2, ambient temperature is 20°C. Using Raimondi and Boyd curve determine the oil film thickness, coefficient of friction, heat generated in the bearing, Heat dissipated. **(10 Marks)**

* * * * *