B.L.D.E.A'sV.P.Dr.P.G.HALAKATTICOLLEGEOFENGINERINGAND TECHNOLOGY VIJYAPUR 586103

INDEXFILEQUESTIONPAPERSDEC.2023/JAN.2024 DEPARTMENT

OF MECHANICAL

3rd4th5th6th7thand8thSEMESTER

S/ 18 III Sem ME

CBCS SCHEME

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

18ME32

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
Mechanics of Materials

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define: (i) Stress (ii) Elasticity (iii) Hooke's law (iv) Principle of superposition. **(04 Marks)**

b. Explain stress-strain diagram of mild steel indicating its salient points. **(06 Marks)**

c. A brass bar having cross-sectional area 1100 mm^2 subjected to axial force as shown in Fig.Q1(c). Determine the total elongation of the bar by assuming the modulus of elasticity as 106 GN/m^2.

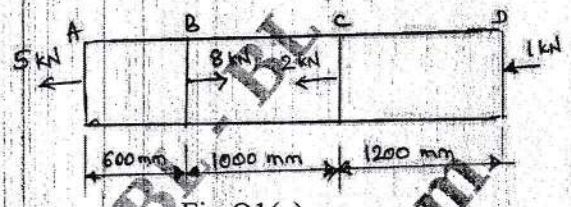


Fig.Q1(c) **(10 Marks)**

OR

2 a. From first principles establish the relationship between Young's modulus and bulk modulus. **(06 Marks)**

b. Derive an expression for the extension of uniformly tapering circular bar subjected to axial load. **(06 Marks)**

c. A bar of brass 25mm diameter is enclosed in a steel tube of 50mm external diameter and 25mm internal diameter. The bar and tube fastened at the ends and are 1.5m long. Find the stresses in the two materials when the temperature raises from 30°C to 80°C.
Take E_{steel} = 200 GPa , E_{brass} = 100 GPa , $\alpha_{steel} = 11.6\times10^{-6}$/°C, $\alpha_{brass} = 18.7\times10^{-6}$/°C. **(08 Marks)**

Module-2

3 a. Show that sum of the normal stresses on any two planes at right angles in a general 2-D stress system is constant. **(05 Marks)**

b. An element is subjected to stress system as shown in Fig.Q3(b). Determine (i) Normal and tangential stress on the oblique plane. (ii) Resultant stress (iii) Angle of obliquity (iv) Principal stresses and their planes (v) Maximum shear stress and its planes.

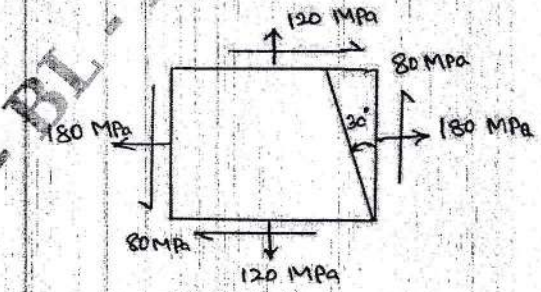


Fig.Q3(b) **(15 Marks)**

OR

4 a. State the assumptions made in the cylinders. Derive an expression for circumferential stress and longitudinal stress for thin cylinders. **(10 Marks)**

b. A thick cylinder of 500mm inner diameter is subjected to an internal pressure of 9 MPa. Taking the allowable stress for the material of the cylinder as 40 MPa, determine the wall thickness of the cylinder. **(10 Marks)**

Module-3

5 a. Define (i) Shear force (ii) Bending Moment (iii) Point of contraflexure. **(03 Marks)**

b. Derive an expression to establish the relationship between the intensity of load, shear force and bending moment. **(05 Marks)**

c. Draw shear force and bending moment diagram for the beam shown in Fig.Q5(c). Mark the position of maximum bending moment and determine its value. Also find the point of contraflexure.

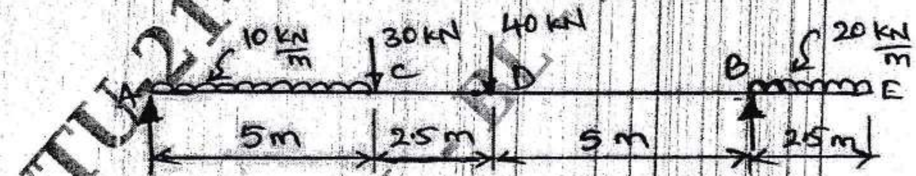


Fig.Q5(c) **(12 Marks)**

OR

6 a. List the assumptions made in theory of pure bending. **(04 Marks)**

b. Prove that the maximum shear stress is 1.5 times the average shear stress in a beam of rectangular cross-section. **(06 Marks)**

c. A cast iron beam of T-section with flange dimensions 100mm×20mm and web 80mm×20mm. The beam is simple supported over a span of 8m. The beam is uniformly distributed load of 1.5 kN/m length over the entire span. Determine the maximum tensile and maximum compressive stresses. Plot the stress distribution. **(10 Marks)**

Module-4

7 a. State the assumptions in the theory of pure torsion. Derive torsion equation with usual notations. **(10 Marks)**

b. Determine the diameter of a solid steel shaft which will transmit 90 kW at 160 rpm. Also determine the length of the shaft if the twist must not exceed 1° over the entire length. The maximum shear stress is limited to 60 N/mm^2. Take the value of modulus of rigidity as 8×10^4 MPa. **(10 Marks)**

OR

8 a. Prove that a hollow shaft is stronger than solid shaft of the same material, length and weight. **(06 Marks)**

b. Explain maximum principal stress theory and maximum shear stress theory. **(06 Marks)**

c. The stresses induced at a critical point in a machine component made of steel are as $\sigma_x = 100$ MPa, $\sigma_y = 40$ MPa, $\tau_{xy} = 80$ MPa. Calculate the factor of safety by i) Maximum normal stress theory ii) Maximum shear stress theory. Take $\sigma_{yield} = 380$ MPa. **(08 Marks)**

Module-5

9 a. Derive an expression for Euler's buckling load of a column for one end fixed and other end free. **(10 Marks)**

b. Find the Euler's crippling load for a hollow cylindrical steel column 40mm external diameter and 4mm thickness. The length of the column is 2.5m and it is hinged at both ends. Also compute the Rankine's crippling load using constant $\sigma_c = 335$ MPa and $\alpha = \frac{1}{7500}$. Take E = 205 GPa. **(10 Marks)**

OR

10 a. State Castigliano's theorem I and II. **(04 Marks)**

b. Derive an expression for strain energy due to shear stress. **(08 Marks)**

c. Determine the strain energy of the simply supported prismatic beam, subjected to uniformly distributed load 25 kN/m over total span of 10m. Assume $I = 195.3 \times 10^3\ mm^4$, $E = 2\times10^5$MPa **(08 Marks)**

* * * * *

CBCS SCHEME

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

18ME33

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
Basic Thermodynamics

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of Thermodynamics DHB and Steam tables permitted.

Module-1

1 a. With an example, define the terms :
(i) Microscopic approach
(ii) Open system
(iii) Intensive properties
(iv) Mechanical equilibrium
(v) Path function. **(10 Marks)**

b. State Zeroth law of thermodynamics and explain the concepts of temperature. **(04 Marks)**

c. A thermocouple with test junction at t °C on gas thermometer scale and reference junction at ice point gives the e.m.f as,
$e = 0.20t - 5\times10^{-4}\,t^2$ mV
The millivoltmeter is calibrated at ice and steam points. What will be reading on this thermometer where the gas thermometer reads 70 °C? **(06 Marks)**

OR

2 a. Explain Quasi-static process with a neat sketch. **(06 Marks)**

b. With a neat sketch, explain constant volume gas thermometer. **(06 Marks)**

c. A temperature scale of certain thermometer is given by the relation t = a ln p + b where a and b are constants and p is the thermometric property of the fluid in the thermometer. If at the ice point and steam point the thermometric properties are found to be 1.5 and 7.5 respectively. What will be the temperature corresponding to the thermometric property of 3.5 on Celsius scale. **(08 Marks)**

Module-2

3 a. Write the differences and similarities between work and heat transfer. **(06 Marks)**

b. With the help of P-V diagrams derive expressions for various displacement work. **(08 Marks)**

c. To a closed system 150 kJ of work is supplied. If the initial volume is 0.6 m^3 and pressure of the system changes as p = 8 – 4 V, where p is in the bar and V is in m^3, determine the final volume and pressure of the system. **(06 Marks)**

OR

4 a. Explain Joules experiments and hence define first law of thermodynamics. **(06 Marks)**

b. With proper assumptions derive SFEE and apply the same for nozzles and compressors. **(08 Marks)**

c. In a gas turbine unit, the gases flow through the turbine is 15 kg/s and the power developed by the turbine is 12000 kW. The enthalpies of gases at the inlet and outlet are 1260 kJ/kg and 400 kJ/kg respectively and the velocities are 50 m/s and 110 m/s respectively. Calculate (i) The rate at which heat is rejected to the turbine and (ii) Area of the inlet pipe when specific volume of the gas at the inlet is 0.45 m^3/kg. **(06 Marks)**

Module-3

5 a. Briefly explain the terms :
   (i) Thermal reservoir.
   (ii) Reversed heat engine.
   (iii) Kelvin Planck's statement of second law of thermodynamics.
   (iv) PMMII **(08 Marks)**

b. Explain the equivalence of Clausius statement to the Kelvin-Planck statement. **(06 Marks)**

c. A reversible heat engine operates between two reservoirs at temperatures 700°C and 50°C. The engine drives a refrigerator which operates between reservoirs at temperatures of 50°C and −25°C. The heat transfer to the engine is 2500 kJ and the net work output of the combined engine refrigerator plant is 400 kJ. Determine the heat transfer to the refrigerant and the net heat transfer to the reservoir at 50°C. **(06 Marks)**

OR

6 a. Show that entropy is a property of the system. **(05 Marks)**

b. Explain inequality of Clausius. **(07 Marks)**

c. 3 kg of water at 80°C is mixed with 4 kg of water at 15°C in an isolated system. Calculate the change of entropy due to mixing process. **(08 Marks)**

Module-4

7 a. Briefly explain the terms availability and unavailable energy. **(04 Marks)**

b. Derive an expression for maximum useful work in a reversible process. **(06 Marks)**

c. 8 kg of air at 650 K and 5.5 bar pressure is enclosed in a system. If the atmospheric temperature and pressure are 300 K and 1 bar respectively. Determine (i) Availability if the system goes through the ideal work producing process. (ii) Availability and effectiveness if the air is cooled at constant pressure to atmospheric temperature. Take $C_V = 0.718$ kJ/kg K and $C_P = 1.005$ kJ/kgK. **(10 Marks)**

OR

8 a. With a neat sketch and h-s diagram, explain throttling calorimeter. **(08 Marks)**

b. Explain T-S diagram for a pure substance. **(05 Marks)**

c. A vessel of volume 0.04 m^3 contains a mixture of saturated water and saturated steam at a temperature of 250°C. The mass of the liquid present is 9 kg. Find the pressure, mass, specific volume, enthalpy, entropy and internal energy. **(07 Marks)**

Module-5

9 a. Briefly explain Dalton's law of partial pressures and Amagat's law of additive volumes. **(04 Marks)**

b. Differentiate between ideal gas and real gas. **(04 Marks)**

c. A mixture of ideal gases contains and 4 kg of nitrogen and 6 kg of carbon dioxide at a pressure of 4 bar and temperature of 20°C. Find :
   (i) Mole fraction of each constituents.
   (ii) Equivalent molecular weight of the mixture.
   (iii) Equivalent gas constant of the mixture.
   (iv) Partial pressures and partial volumes.
   (v) Volume and density of the mixture. **(12 Marks)**

OR

10 a. Briefly explain law of corresponding states and compressibility factor. **(04 Marks)**

b. Write Vanderwaal's constants in terms of critical properties. **(08 Marks)**

c. 1 kg of carbon di oxide has a volume of 1 m^3 at 100°C. Compute the pressure by
   (i) Vanderwaal's equation
   (ii) Perfect gas equation. **(08 Marks)**

* * * * *

CBCS SCHEME

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

18ME34

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
Material Science

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define APF and Coordination number. Calculate the APF for HCP structure. **(08 Marks)**
b. Differentiate Edge dislocation and Screw dislocation. **(06 Marks)**
c. State and explain Fick's I and II law of diffusion. **(06 Marks)**

OR

2 a. List the Mechanical properties in Plastic range. Explain them briefly. **(08 Marks)**
b. With a neat sketch, explain the ductile to Brittle transition. **(06 Marks)**
c. With a neat sketch, explain the Plastic deformation by slip and twinning. **(06 Marks)**

Module-2

3 a. Differentiate between ductile and brittle fractures with sketches. **(07 Marks)**
b. What is Fatigue? What are the factors affecting the Fatigue life? **(05 Marks)**
c. What is Creep? Explain the Creep curve. **(08 Marks)**

OR

4 a. Draw the Iron carbon diagram and indicate the phase temperatures and explain the different phases in Iron carbon diagram. **(12 Marks)**
b. Define Homogeneous and Heterogenous nucleation. Obtain an expression for critical radius of nucleation. **(08 Marks)**

Module-3

5 a. What is Heat treatment? Explain the TTT diagram for Eutectoid steel. **(09 Marks)**
b. Differentiate between Annealing and Normalizing. **(05 Marks)**
c. Explain Martempering with neat sketch. **(06 Marks)**

OR

6 a. With a neat sketch, explain Nitriding process and write its applications. **(08 Marks)**
b. With a neat sketch, explain the Progressive flame hardening. **(06 Marks)**
c. Give the compositions and applications of Grey Cast Iron and Spheroidal Graphite Iron. **(06 Marks)**

Module-4

7 a. What are Composite Materials? What are the advantages , limitations and applications of Composite materials. **(08 Marks)**
b. Explain Metal Matrix Composites and Ceramic Matrix Composites. **(06 Marks)**
c. What is the role of : i) Matrix ii) Reinforcement. **(06 Marks)**

OR

8 a. Derive the rule of mixtures for the Modulus of elasticity of a fiber reinforce composite when a stress is applied along the axis of fibers. **(08 Marks)**

b. With a neat sketch, explain the Sheet Moulding Compound Process. **(06 Marks)**

c. Calculate the volume ratio of Aluminum and Boron in Aluminum - Boron composite which can have the Young's modulus of Aluminum , Boron and Iron are respectively 71 GPa , 440GPa and 210 GPa. **(06 Marks)**

Module-5

9 a. Define Ceramic. Explain briefly the types of Ceramics and its applications. **(08 Marks)**

b. Differentiate the Thermoplastics and Thermosetting Plastics. **(06 Marks)**

c. With a neat sketch, explain the Resin transfer moulding. **(06 Marks)**

OR

10 a. Explain the materials used as implants in Human body. **(06 Marks)**

b. Write a note on Piezo electrical material and its applications. **(06 Marks)**

c. Explain the use of Non Destructive Testing for Residual Life Assessment. **(08 Marks)**

* * * * *

CBCS SCHEME

USN 2BL19ME086

18ME35B/18MEB305

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
Metal Casting and Welding

Time: 3 hrs. Max. Marks: 100

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

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

Module-1

1 a. Explain casting terminology involved in casting process with a neat sketch. **(08 Marks)**

b. List the types of pattern and explain the following patterns with neat sketches:
(i) Gatted pattern (ii) Match plate pattern **(08 Marks)**

c. Write a short note on Binders and Additives. **(04 Marks)**

OR

2 a. With a neat sketch, explain Jolt-Squeeze type molding machine, showing pattern and mold box. **(08 Marks)**

b. Explain with neat sketch, shell moulding process. **(08 Marks)**

c. Explain balanced core with neat sketch. **(04 Marks)**

Module-2

3 a. Explain with neat sketch Hot chamber die casting. **(08 Marks)**

b. With a neat sketch explain Thixo casting process. **(08 Marks)**

c. Explain with neat sketch True-Centrifugal casting process. **(04 Marks)**

OR

4 a. With a neat sketch, describe the zones of cupola furnace. **(10 Marks)**

b. Explain with a diagram of working of coreless induction furnace. **(10 Marks)**

Module-3

5 a. Explain with neat sketch, solidification process. **(08 Marks)**

b. Explain the methods used to control the directional solidification. **(06 Marks)**

c. Explain with neat sketch flushing type degasification process. **(06 Marks)**

OR

6 a. Explain with neat sketch stir casting process. **(08 Marks)**

b. What are the advantages and disadvantages of aluminium castings? **(04 Marks)**

c. Explain the different types of casting defects along with causes and remedies. **(08 Marks)**

Module-4

7 a. Define welding process. Explain Tungesten Inert Gas (TIG) welding process with neat sketch. **(10 Marks)**

b. Explain atomic hydrogen welding with neat sketch. **(10 Marks)**

OR

8 a. With a neat diagram, explain LASER welding process and mention its advantage and disadvantage. **(10 Marks)**

b. With a neat sketch, explain seam welding process. **(08 Marks)**

c. Mention the advantages and disadvantages of resistance welding

Module-5

9 a. Explain the types of flames in Oxy-acetylene welding process with sketches. **(08 Marks)**

b. Explain the formation of different zones in welding with a neat sketch. **(08 Marks)**

c. Differentiate between soldering and brazing. **(04 Marks)**

OR

10 a. Explain the welding defects, causes and remedies. **(08 Marks)**

b. Explain with neat sketch ultrasonic inspection method. **(08 Marks)**

c. Explain the concept of electrodes. **(04 Marks)**

* * * * *

CBCS SCHEME

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

18ME36B/18MEB306

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
Mechanical Measurement and Metrology

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. What is metrology? State the objectives of metrology. **(06 Marks)**

b. Define metre in terms of wavelength standards. List the advantages of wavelength standards over material standards. **(06 Marks)**

c. Three 100mm end bars are measured on a level comparator by first wringing them together and comparing with 300mm bar. There was error of 0.03 mm and three bars together have total error of 0.064mm less than the standard bar. Bar A is 0.02mm longer than bar C. Determine the actual dimensions of all end bars. **(08 Marks)**

OR

2 a. Write the limitations of line standard and end standard. **(04 Marks)**

b. Using M112 set of slip gauges, build the following dimensions : i) 52.498 ii) 48.3275. **(08 Marks)**

c. Explain the principle of autocollimator with neat figure. **(08 Marks)**

Module-2

3 a. Define the following terms:
(i) Limits (ii) Fits (iii) Tolerance. **(06 Marks)**

b. Explain with a sketch, Taylor's principle for design of limit gauges. **(06 Marks)**

c. Design a plug gauge for checking the hole $60H_8$, IT8 = 25i and diameter step 50 to 80 mm. **(08 Marks)**

OR

4 a. What is comparator? How the comparators are classified? **(04 Marks)**

b. Explain with sketch, the construction and working of LVDT. **(08 Marks)**

c. Differentiate between mechanical comparators and Pneumatic comparators. **(08 Marks)**

Module-3

5 a. With a sketch, explain the construction of a tool maker's microscope. What are its applications? **(10 Marks)**

b. Derive an expression for the effective diameter of a screw thread by 3-wire method. **(10 Marks)**

OR

6 a. With a neat sketch, explain the terminology of spur gear. **(10 Marks)**

b. Derive an expression for the chordal tooth thickness of gear. **(10 Marks)**

Module-4

7 a. Define
i) Calibration ii) Precision iii) Accuracy iv) Sensitivity v) Linearity. **(10 Marks)**
b. What is the significance of measurement? **(04 Marks)**
c. Explain with neat sketch, the principle of Piezo-electric transducer. **(06 Marks)**

OR

8 a. Explain the working of cathode ray oscilloscope. **(10 Marks)**
b. Explain the three stages of generalized measurement method using any one example. **(10 Marks)**

Module-5

9 a. With a neat sketch explain the Pirani gauge used for pressure measurement. **(10 Marks)**
b. Explain the working of McLeod gauge with neat sketch. **(10 Marks)**

OR

10 a. What are the types of dynamometers? **(04 Marks)**
b. What is thermocouple? State the laws of thermocouple. **(06 Marks)**
c. Describe the strain measurement by neat figure. **(10 Marks)**

* * * * *

CBCS SCHEME

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

18MATDIP31

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
Additional Mathematics – I

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Express $\sqrt{8}+4i$ in the polar form and hence find its modulus and amplitude. **(08 Marks)**

b. Find the real part of $\dfrac{1}{1+\cos\theta-i\sin\theta}$ **(06 Marks)**

c. Show that $(1+\cos\theta+i\sin\theta)^n+(1+\cos\theta-i\sin\theta)^n=2^{n+1}\cos^n\left(\dfrac{\theta}{2}\right)\cos\left(\dfrac{n\theta}{2}\right)$ **(06 Marks)**

OR

2 a. If $\vec{A}=\hat{i}+2\hat{j}+3\hat{k}$, $\vec{B}=-\hat{i}+2\hat{j}+\hat{k}$ and $\vec{C}=3\hat{i}+\hat{j}$, find p such that $\vec{A}+p\vec{B}$ is perpendicular to $\vec{C}$. **(08 Marks)**

b. Find the area of the parallelogram whose adjacent sides are the vectors $\vec{A}=2\hat{i}+4\hat{j}-5\hat{k}$ and $\vec{B}=\hat{i}+2\hat{j}+3\hat{k}$. **(06 Marks)**

c. If $\vec{A}=\hat{i}+2\hat{j}-3\hat{k}$ and $\vec{B}=3\hat{i}-\hat{j}+2\hat{k}$ then show that $\vec{A}+\vec{B}$ and $\vec{A}-\vec{B}$ are orthogonal. **(06 Marks)**

Module-2

3 a. Obtain the Maclaurin's series expansion of log(sec x) upto the term containing x^3. **(08 Marks)**

b. Using Euler's theorem, prove that $xu_x+yu_y=\dfrac{5}{2}u$ where $u=\dfrac{x^3+y^3}{\sqrt{x+y}}$ **(06 Marks)**

c. If u = f(x – y, y – z, z – x), then show that $u_x+u_y+u_z=0$. **(06 Marks)**

OR

4 a. Prove that

$$\sqrt{1+\sin 2x}=1+x-\frac{x^2}{2}-\frac{x^3}{6}+\frac{x^4}{24}+\ldots\ldots$$ by using Maclaurin's series. **(08 Marks)**

b. If $u=\sin^{-1}\left\{\dfrac{x^2y^2}{x+y}\right\}$, then show that $xu_x+yu_y=3\tan u$, by using Euler's theorem. **(06 Marks)**

c. If $u=2xy$, $v=x^2-y^2$ and $x=r\cos\theta$, $y=r\sin\theta$, find $\dfrac{\partial(u,v)}{\partial(r,\theta)}$. **(06 Marks)**

Module-3

5 a. A particle moves along the curve $x=1-t^3$, $y=1+t^2$, $z=2t-5$ where t is time. Find the components of velocity and acceleration at t = 1 in the direction $2\hat{i}+\hat{j}+2\hat{k}$ **(08 Marks)**

b. Find the unit normal to the surface $xy^3z^2=4$ at $(-1,-1,2)$ **(06 Marks)**

c. Show that $\vec{F}=(x+y+z)\hat{i}+(x+2y-z)\hat{j}+(x-y+2z)\hat{k}$ is irrotational. **(06 Marks)**

OR

6 a. Find $\nabla \cdot \vec{F}$ and $\nabla \times \vec{F}$ where $\vec{F} = \nabla(x^3 + y^3 + z^3 - 3xyz)$ **(08 Marks)**

b. If $\vec{F} = (x + y + 1)\hat{i} + \hat{j} - (x + y)\hat{k}$, then show that $\vec{F} \cdot \text{curl}\,\vec{F} = 0$. **(06 Marks)**

c. Find the value of a such that $\vec{F} = (x + 3y)\hat{i} + (y - 2z)\hat{j} + (x + az)\hat{k}$ is solenoidal. **(06 Marks)**

Module-4

7 a. Evaluate

$$\int_0^{\pi/2} \sin^5 x \, dx$$

(08 Marks)

b. Evaluate $\int_0^{\infty} \frac{x^4}{(1+x^2)^4} dx$ **(06 Marks)**

c. Evaluate $\iint_R (x^2 + y^2)\,dx\,dy$ where R is the region bounded by y = x and $y = x^2$. **(06 Marks)**

OR

8 a. Evaluate

$$\int_0^{\pi/2} \cos^6 x \, dx$$

(08 Marks)

b. Evaluate $\int_0^{a} x\sqrt{ax - x^2}\, dx$ **(06 Marks)**

c. Evaluate $\int_0^a \int_0^b \int_0^c (x + y + z)\,dx\,dy\,dz$ **(06 Marks)**

Module-5

9 a. Solve : $y(2x - y + 1)dx + x(3x - 4y + 3)dy = 0$ **(08 Marks)**

b. Solve : $\frac{dx}{dy} + \frac{y\cos x + \sin y + y}{\sin x + x\cos y + x} = 0$ **(06 Marks)**

c. Solve : $\frac{dx}{dy} + \frac{2y}{x} = y^2 x$ **(06 Marks)**

OR

10 a. Solve : $\frac{dy}{dx} + \frac{y}{x} = y^2 x$ **(08 Marks)**

b. Solve : $(5x^4 + 3x^2y^2 - 2xy^3)dx + (2x^3y) - 3x^2y^2 - 5y^4)dy = 0$ **(06 Marks)**

c. Solve : $\frac{dy}{dx} + y\cot x = \cos x$ **(06 Marks)**

* * * * *

21 III sem. ME

CBCS SCHEME

USN | | | | | | | | | |

21ME32

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
Metal Casting, Forming and Joining Process

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. What is pattern? Classify the types of pattern explain any one pattern used in casting with sketch. **(10 Marks)**

b. List the types of base sand and explain the requirement of base sand. **(10 Marks)**

OR

2 a. Explain the jolt machine and squeeze machine used in moulding process with sketch. **(10 Marks)**

b. Discuss the CO_2 moulding process with neat sketch and list advantages and disadvantages. **(10 Marks)**

Module-2

3 a. Explain working principle of Direct electric arc furnace with neat sketch. **(10 Marks)**

b. Explain working principle of Coreless induction furnace with neat sketch. **(10 Marks)**

OR

4 a. Define pressure die casting? Explain the hot chamber die casting neat sketch. **(10 Marks)**

b. Explain the working principle of centrifugal casting and squeeze casting with neat sketch. **(10 Marks)**

Module-3

5 a. Differentiate between Hot working and Cold working of metal forming. **(10 Marks)**

b. What is forging? Explain the open die forging and closed die forging with neat sketch. **(10 Marks)**

OR

6 a. Explain Tendem Rolling mill and planetary rolling mill with neat sketch. **(10 Marks)**

b. Explain with neat sketch :
i) Direct extrusion ii) Hydrostatic extrusion. **(10 Marks)**

Module-4

7 a. Explain the oxy-acetylene gas welding and its types of flames with neat sketches. **(10 Marks)**

b. Sketch and explain Tungsten Inert Gas (TIG) welding and list its advantages and disadvantages. **(10 Marks)**

OR

8 a. Explain the manual metal arc welding with neat sketch and list its advantages, disadvantages and applications. **(10 Marks)**

b. Explain the Submerged Arc Welding (SAW) with neat sketch and list advantages, disadvantages and applications. **(10 Marks)**

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

Module-5

9 a. Distinguish between Soldering, Brazing and Welding. **(10 Marks)**

b. Explain the friction stir welding and resistance welding with neat sketch. **(10 Marks)**

OR

10 a. Explain the welding defects, causes and remedies with suitable sketches. **(10 Marks)**

b. Write a short notes on:

i) Concept of welding

ii) Thermal effects of welding. **(10 Marks)**

* * * * *

CBCS SCHEME

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

21ME33

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
Material Science and Engineering

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Clearly differentiate between Crystalline solids and Amorphous solids. **(06 Marks)**

b. What is meant by atomic packing factor? Find the atomic packing factor for hexagonal close packed unit cells. **(08 Marks)**

c. Explain clearly the classification of voids. **(06 Marks)**

OR

2 a. Explain the crystal structure analysis using X-ray diffraction method. Also define Bragg's law. **(08 Marks)**

b. Explain different types of point imperfections with neat sketches. **(06 Marks)**

c. Differentiate between edge dislocation and screw dislocations. **(06 Marks)**

Module-2

3 a. Explain different types of solid solutions with sketches. Also explain Home Rothery Rules for formation of solid solution. **(10 Marks)**

b. State and explain Fick's laws of diffusion. Also explain factors affecting diffusion. **(10 Marks)**

OR

4 a. Explain with a neat sketch solid solution phase diagram. **(08 Marks)**

b. Draw the iron-carbon diagram and label all the phases, temperatures and invariant points on it. **(08 Marks)**

c. Explain the Gibb's phase rule. **(04 Marks)**

Module-3

5 a. Define homogeneous nucleation. Derive the expression for critical radius and activation energy in homogeneous nucleation. **(10 Marks)**

b. Explain the mechanism of plaster deformation by slip and twinning. **(10 Marks)**

OR

6 Explain the following :

a. Annealing

b. Normalising

c. Hardening

d. Tempering **(20 Marks)**

Module-4

7 a. With a neat sketch, explain the physical vapor deposition technique. **(08 Marks)**

b. Discuss the different surface coating materials used for different applications. **(06 Marks)**

c. With a neat sketch, explain the electro deposition method of coating metal surfaces. **(06 Marks)**

OR

8	a.	Explain briefly the production of metal powders.	**(10 Marks)**
	b.	Explain with neat sketches the different compacting techniques.	**(10 Marks)**

Module-5

9	a.	Write a brief note on general procedure used in design.	**(06 Marks)**
	b.	Briefly discuss the factors influencing the selection of suitable material for design.	**(06 Marks)**
	c.	Discuss the important mechanical properties of engineering materials.	**(08 Marks)**

OR

10	a.	Draw the stress-strain curve for mild steel and explain the salient points.	**(08 Marks)**
	b.	Briefly explain codes and standards in design.	**(06 Marks)**
	c.	Briefly discuss the selection of manufacturing methods.	**(06 Marks)**

* * * * *

CBCS SCHEME

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

21ME34

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
Thermodynamics

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Steam tables may be permitted.

Module-1

1 a. What is meant by thermometric property? Elucidate with a neat sketch of thermocouple type and vapor pressure thermometers. **(10 Marks)**

b. Define a thermodynamic system. Differentiate between open system, closed system and an isolated system. **(06 Marks)**

c. Explain the following terms : i) State ii) Process iii) Cycle. **(04 Marks)**

OR

2 a. A fluid is contained in a cylinder by a spring loaded, friction less piston so that the pressure in the fluid is a linear function of the volume (p = a + bv). The internal energy of the fluid is given by the following equation: U = 42 + 3.6pV, where U is in kJ, P in kPa and V in cubic metre. If the fluid changes from an initial state of 190kPa, 0.035m^3 to a final state of 420 kPa, 0.07m^3, with no work other than that done on the piston. Find the direction and magnitude of the work and heat transfer. **(10 Marks)**

b. State and explicate the Steady Flow Energy Equations (S.F.E.E) with engineering applications. **(06 Marks)**

c. In an internal combustion engine, during the compression stroke the heat rejected to the cooling water is 50kJ/kg and the work input is 100kJ/kg. Calculate the change in internal energy of the working fluid stating whether it is a gain or loss. **(04 Marks)**

Module-2

3 a. Describe the working of a carnot cycle with a P-V diagram. **(10 Marks)**

b. Enumerate the Clausius inequality with a layout diagram. **(06 Marks)**

c. Define heat engine, refrigerator and heat pump. **(04 Marks)**

OR

4 a. A reversible heat engine operates between two reservoirs at temperature 727°C and 27°C, the engine drives a reversible refrigerator which working between reservoirs at temperature of 27°C and -20°C. The heat absorbed by engine is 2600kJ and the net work output of combined engine refrigerator plant is 500kJ. Determine the heat transfer to the refrigerant and the net heat transfer to the reservoir at 27°C. **(10 Marks)**

b. Define:
i) PMM I
ii) PMM II
iii) Thermal Energy Reservoirs (TET)
iv) Available energy and unavailable energy. **(06 Marks)**

c. What do you mean by the term 'Entropy'? Prove that entropy is a property of a system. **(04 Marks)**

Module-3

5 a. Derive the Maxwell's relations and explain their importance in thermodynamics. **(10 Marks)**

b. Brief about the Clausius-Clapeyron equation for evaporation of liquids. **(06 Marks)**

c. Explicate the Joule Kelvin effect and its significance in engineering applications. **(04 Marks)**

OR

6 a. With a neat sketch, expound the flue gas analysis apparatus. (Orsat apparatus). **(10 Marks)**

b. Dry exhaust gases from an oil engine have the following composition by volume carbon dioxide 8.85%, carbon monoxide 1.2%, oxygen 6.8% and nitrogen 83.15%. The fuel oil has a percentage composition of mass as carbon 82%, hydrogen 14% and oxygen 2%. Determine : i) Mass of carbon per kg of flue gas ii) Air fuel ratio. **(06 Marks)**

c. Define compressibility factor, compressibility chart and its applications. **(04 Marks)**

Module-4

7 a. A vessel having a capacity of $0.05m^3$ contains a mixture of saturated water and saturated steam at a temperature of 245°C. The mass of liquid present is 10kg.
Find the following:
i) The pressure
ii) The mass
iii) The specific volume
iv) The specific enthalpy
v) The specific entropy
vi) The specific internal energy. **(10 Marks)**

b. What amount of heat would be required to produce 4.4kg of steam at a pressure of 6 bar and temperature of 250°C from water at 30°C? Take specific heat for super heated steam as 2.2kJ/kg K. **(06 Marks)**

c. Brief about
i) Triple point and critical point
ii) Mollier chart. **(04 Marks)**

OR

8 a. A steam turbine is fed with steam having an enthalpy of 3100kJ/kg. It moves out of the turbine with an enthalpy of 2100kJ/kg. Feed heating is done at a pressure of 3.2 bar with steam enthalpy of 2500kJ/kg. The condensate from a condenser with an enthalpy of 125kJ/kg enters into the feed heater. The quantity of bled steam is 11200 kg/h. Find the power developed by turbine. Assume that the water leaving the feed heater is saturated liquid at 3.2 bar and the heater is direct mixing type neglect pump work. **(10 Marks)**

b. In a steam power cycle, the steam supply is at 15 bar and dry saturated. The condenser pressure is 0.4 bar. Calculate the carnot and ranking efficiencies of the cycle. Neglect pump work. **(06 Marks)**

c. State the advantages of regenerative cycle and reheat cycle over the simple ranking cycle. **(04 Marks)**

Module-5

9 a. Derive the Otto cycle with P-V diagram and compare with diesel and duel cycle efficiency and compression ratio. **(10 Marks)**

b. The minimum pressure and temperature in an Otto cycle are 100kPa and 27°C. The amount of heat added to the air per cycle is 1500kJ/kg.

i) Determine the pressures and temperatures at all points of the air standard otto cycle.

ii) Also calculate the specific work and thermal efficiency of the cycle for a compression ratio of 8:1.

Take for air : $C_V = 0.72$kJ/kg K, and $\gamma = 1.4$. **(06 Marks)**

c. Brief about the Ericsson cycle with applications. **(04 Marks)**

OR

10 a. Explicate briefly about the Brayton cycle. Derive expression for optimum pressure ratio. **(10 Marks)**

b. In a gas turbine power plant, the air enters the compressor at 1.0 bar and 20°C. The pressure of air leaving the compressor is 3.5 bar and the temperature at turbine inlet is 600°C. Determine per kg of air:

i) Efficiency of the cycle

ii) Heat supplied to air

iii) Work available at the shaft. **(06 Marks)**

c. What are the methods for improvement of thermal efficiency of Brayton cycle and explain any one method. **(04 Marks)**

* * * * *

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

21MAT31

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
Transform Calculus Fourier Series & Numerical Techniques

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Find the Laplace transform of, (i) $e^{-3t}\sin 5t.\cos 3t$ (ii) $\frac{e^{at}-e^{bt}}{t}$. **(06 Marks)**

b. If a periodic function of period 'a' is defined by $f(t)=\begin{cases} E, & \text{for } 0<t<\frac{a}{2} \\ -E, & \text{for } \frac{a}{2}<t<a \end{cases}$ then show that $L\{f(t)\}=\frac{E}{S}\tanh\left(\frac{as}{4}\right)$. **(07 Marks)**

c. Using convolution theorem find the inverse Laplace transform of $\frac{s}{(s+2)(s^2+9)}$. **(07 Marks)**

OR

2 a. Express the function $f(t)=\begin{cases} \cos t & \text{for } 0<t<\pi \\ \cos 2t & \text{for } \pi<t<2\pi \\ \cos 3t & t>2\pi \end{cases}$ interms of unit step function and hence find its Laplace transform. **(07 Marks)**

b. Find the inverse laplace transform of $\frac{2s^2-6s+5}{s^3-6s^2+11s-6}$. **(06 Marks)**

c. Solve the differential equation $\frac{d^2y}{dt^2}+4\frac{dy}{dt}+4y=e^{-t}$ with $y(0) = y'(0)=0$ by using Laplace transform. **(07 Marks)**

Module-2

3 a. Find a Fourier series to represent $f(x) = |x|$ in $-\pi \le x \le \pi$. **(06 Marks)**

b. Obtain the half-range cosine series for $f(x)=x\sin x$ in $(0, \pi)$ and hence show that $\frac{\pi-2}{4}=\frac{1}{1.3}-\frac{1}{3.5}+\frac{1}{5.7}-.....\infty$ **(07 Marks)**

c. Express y as a Fourier series up to second harmonics for the following data :

x:	0	$\frac{\pi}{3}$	$\frac{2\pi}{3}$	π	$\frac{4\pi}{3}$	$\frac{5\pi}{3}$	2π
y:	1	1.4	1.9	1.7	1.5	1.2	1.0

(07 Marks)

OR

4 a. Obtain the Fourier series expansion for the function, $f(x) = 2x - x^2$ in (0, 2). **(06 Marks)**

b. Find the half range sine series for the function, $f(x) = \begin{cases} \frac{1}{4} - x & \text{for } 0 < x < \frac{1}{2} \\ x - \frac{3}{4} & \text{for } \frac{1}{2} < x < 1 \end{cases}$ **(07 Marks)**

c. The following table gives the variation of periodic current over period :

t sec :	0	$\frac{T}{6}$	$\frac{T}{3}$	$\frac{T}{2}$	$\frac{2T}{3}$	$\frac{5T}{6}$	T
A (amp) :	1.98	1.30	1.05	1.30	−0.88	−0.25	1.98

Show that there is a direct current part of 0.75 amp in the variable current and obtain the amplitude of the first harmonic. **(07 Marks)**

Module-3

5 a. Find the Fourier transform of the function $f(x) = \begin{cases} 1 - x^2 & \text{for } |x| \le 1 \\ 0 & \text{for } |x| > 1 \end{cases}$. Hence evaluate $\int_0^\infty \left(\frac{x\cos x - \sin x}{x^3} \right) dx$. **(06 Marks)**

b. Find the Fourier sine and cosine transform of $f(x) = \begin{cases} x & \text{if } 0 < x < 1 \\ 2 - x & \text{if } 1 < x < 2 \\ 0 & \text{otherwise} \end{cases}$. **(07 Marks)**

c. Find the z-transform of $\cosh\left(n\frac{\pi}{2} + \theta \right)$. **(07 Marks)**

OR

6 a. Find the Fourier sine transform of $f(x) = e^{-ax}$, $a > 0$. **(06 Marks)**

b. Find the inverse z transform of $\frac{18z^2}{(2z-1)(4z+1)}$. **(07 Marks)**

c. Solve the difference equation $u_{n+2} + 6u_{n+1} + 9u_n = z^n$ with $u_0 = u_1 = 0$ using z-transform. **(07 Marks)**

Module-4

7 a. Classify the following partial differential equations :

(i) $\frac{\partial^2 u}{\partial x^2} + 4\frac{\partial^2 u}{\partial x \partial y} + 4\frac{\partial^2 u}{\partial y^2} - \frac{\partial u}{\partial x} + 2\frac{\partial u}{\partial y} = 0$.

(ii) $x^2 \frac{\partial^2 u}{\partial x^2} + (1 - y^2)\frac{\partial^2 u}{\partial y^2} = 0$, $-\infty < x < \infty$, $-1 < y < 1$.

(iii) $(1 + x^2)\frac{\partial^2 u}{\partial x^2} + (5 + 2x^2)\frac{\partial^2 u}{\partial x \partial t} + (4 + x^2)\frac{\partial^2 u}{\partial t^2} = 0$.

(iv) $(x + 1)\frac{\partial^2 u}{\partial x^2} - 2(x + 2)\frac{\partial^2 u}{\partial x \partial y} + (x + 3)\frac{\partial^2 u}{\partial y^2} = 0$. **(10 Marks)**

b. Evaluate the values at the mesh points for the equation $u_{tt} = 16u_{xx}$ taking h = 1 upto t = 1.25. The boundary conditions are u(0, t) = u(5, t) = 0 and the initial conditions are $u(x, 0) = x^2(5 - x)$ and $u_t(x, 0) = 0$. **(10 Marks)**

OR

8 a. Using Schmidt two-level formula to solve the equation $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$ under the conditions,

(i) $u(0, t) = u(1, t) = 0 \quad t \geq 0$

(ii) $u(x, 0) = \sin \pi x, \quad 0 < x < 1$ by taking $h = \frac{1}{4}$ and $\alpha = \frac{1}{6}$ co. **(10 Marks)**

b. Solve the two-dimensional Laplace equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ at the interior mesh points of the square region and the values of u at the mesh points on the foundary are shown in Fig.Q8 (b).

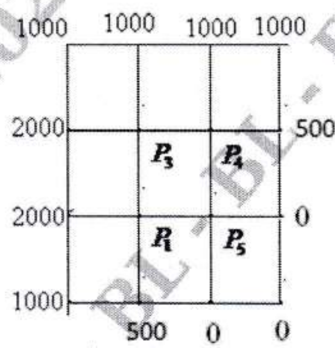


Fig. Q8 (b) **(10 Marks)**

Module-5

9 a. Using Runge-Kutta method of 4[th] order to solve the differential equation $\frac{d^2y}{dx^2} + 2x\frac{dy}{dx} - 4y = 0$ with $y(0) = 0.2$ and $y'(0) = 0.5$ for $x = 0.1$. Correct to four decimal places. **(07 Marks)**

b. State and prove Euler's equation. **(07 Marks)**

c. Find the extremal of the functional $I = \int_0^{\frac{\pi}{2}} \left(y^2 - y'^2 - 2y \sin x\right) dx$ under the end conditions $y(0) = 0, \ y\left(\frac{\pi}{2}\right) = 0$ **(06 Marks)**

OR

10 a. Apply Milne's method to compute y(0.3). Given that $\frac{d^2y}{dx^2} = 1 - 2y\frac{dy}{dx}$ and $y(0) = 0$, $y(0.2) = 0.02$, $y(0.4) = 0.0795$, $y(0.6) = 0.1762$, $y'(0) = 0$, $y'(0.2) = 0.1996$, $y'(0.4) = 0.3937$, $y'(0.6) = 0.5689$ **(07 Marks)**

b. Prove that the shortest distance between two points in a plane is a straight line. **(07 Marks)**

c. Find the extremal of the functional $I = \int_{x_1}^{x_2} \left(y^2 + y'^2 + 2ye^x\right) dx$ **(06 Marks)**

* * * * *

© / 22 III Sem ME

CBCS SCHEME

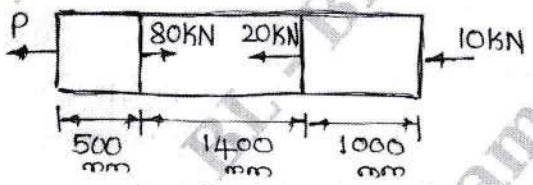
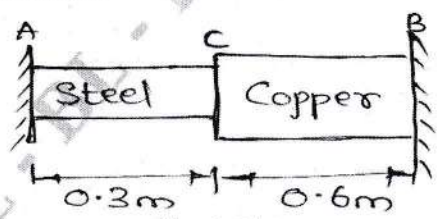
USN | | | | | | | | | | |

BME301

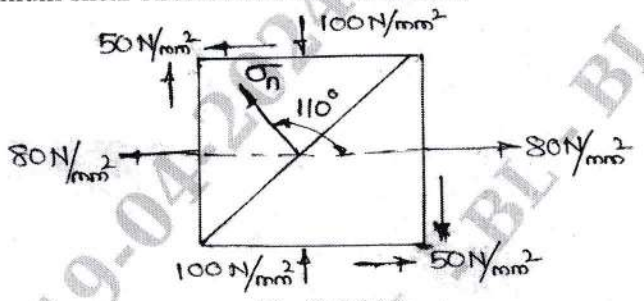
Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024
Mechanics of Materials

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Formula Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	State Hooke's law. Draw a neat diagram of stress-stain curve for mild steel and mark the salient points and zones.	5	L2	CO1
	b.	Derive an expression for elongation in a tapered bar of circular cross-section, subjected to an axial tensile load "F".	7	L3	CO1
	c.	A brass bar having uniform cross-section area of $300mm^2$ is subjected to a load as shown in Fig.1(c). Find the total elongation of bar and the magnitude of load "P" if, E = 84GPa.  Fig.Q.1(c)	8	L3	CO1
		OR			
Q.2	a.	Define the following: i) Poisons ratio ii) Bulk modulus iii) Factor of safety iv) True stress v) Hardness.	5	L2	CO1
	b.	A bar of 20mm diameter is tested in tension. It is observed that when a load of 37.7kN is applied, the extension measured over a gauge length of 200mm is 0.12mm and contraction in diameter is 0.0036mm. Find Poisson's ratio and elastic constants E, G, K.	7	L3	CO1
	c.	A stepped bar is fixed at its two ends rigidly. The bar is free from stresses when its temperature is 30°C. When the temperature is increased to 90°C, determine: i) Stresses induced in copper and steel portions. ii) Displacement at the junction point "C". Take E_c = 100GPa, E_s = 200GPa, $\alpha_c = 1.8 \times 10^{-5}$/°C and $\alpha_s = 1.2 \times 10^{-5}$/°C, $A_s = 80mm^2$, $A_c = 120mm^2$.  Fig.Q.2(c)	8	L3	CO1

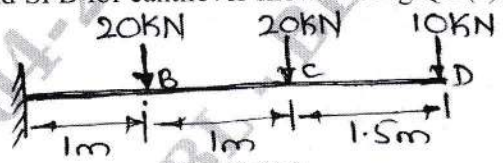
Module – 2

Q.3	a.	Define: i) Principal plane ii) Principal stress iii) Maximum shear stress iv) Plane of maximum shear.	8	L2	CO2
	b.	An element with the stresses acting on it is shown in Fig.Q.3(b), by Mohr's circle method find: i) Normal and shear stress acting on a plane whose normal is at an angle of 110° with respect to x-axis ii) Principal stresses and their locations. iii) Maximum shear stresses and their locations.  Fig.Q.3(b)	12	L3	CO2

OR

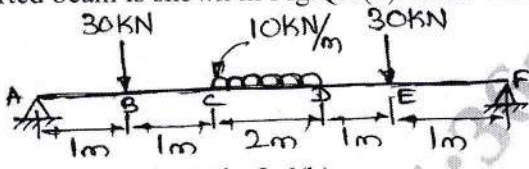
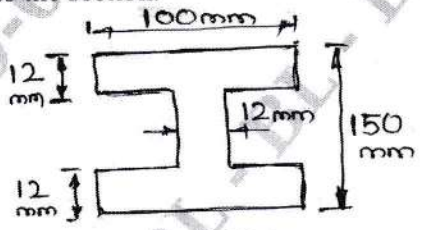
Q.4	a.	Derive expressions for circumferential and longitudinal strains in thin cylinder. Hence show that volumetric strain is $\epsilon_v = \frac{pd}{4tE}(5-4\gamma)$	8	L3	CO2
	b.	A cast iron pipe has 200mm internal diameter and 50mm metal thickness. It carries water at a pressure of 5N/mm^2. Calculate the intensities of circumferential and radial pressures. Sketch the stress distribution across the section.	12	L3	CO2

Module – 3

Q.5	a.	Discuss about different types of beams and loads.	6	L2	CO3
	b.	Obtain a relation between load intensity, shear force and bending moment.	6	L3	CO3
	c.	Draw the BMD and SFD for cantilever shown in Fig.Q.5(c).  Fig.Q.5(c)	8	L3	CO3

OR

Q.6	a.	Define: i) Point of contraflexure ii) Bending moment iii) Shear force.	6	L2	CO3

	b.	A simply supported beam is shown in Fig.Q.6(b). Draw the SFD and BMD.  Fig.Q.6(b)	14	L3	CO3
		Module – 4			
Q.7	a.	List the assumptions made in theory of pure bending. Derive the bending equation with usual notations.	10	L3	CO4
	b.	A simply supported beam of 5m span has a cross-section 150mm × 250mm. If the permissible stress is 10N/mm^2. Find: i) Maximum UDL intensity ii) Maximum concentrated load "P" at 2m from one end.	10	L3	CO4
		OR			
Q.8	a.	A uniform I-section beam is subjected 100kNm bending moment. Plot the stress variation across the section.  Fig.Q.8(a)	10	L3	CO4
	b.	A cantilever of square section 200mm × 200mm and length 2m, fails in flexure when 12kN is placed at free end. A rectangular beam of same material and simply supported over length of 3m, 150mm wide and depth 300mm. Calculate minimum central concentrated load required to break the beam.	10	L3	CO4
		Module – 5			
Q.9	a.	Derive torsion equation. Also list the assumptions.	10	L3	CO5
	b.	Find the shaft diameter required to transmit 60kW at 150rpm, if maximum torque is 25% more than mean torque for a maximum shear stress of 60MPa. Find angle of twist for a 4m length. Take, G = 80GPa.	10	L3	CO5
		OR			
Q.10	a.	Derive an expression for critical load in a column subjected to compressive load, when one end fixed and other free.	10	L3	CO5
	b.	A 1.5m long column has a circular cross-section of 50mm diameter. One end of column is fixed and other end is free. Taking FOS = 3. Calculate safe load using i) Rankines formula, yield stress 560N/mm^2 and $a = \frac{1}{1600}$ ii) Eulers formula, E = 120GPa.	10	L3	CO5

* * * * *

CBCS SCHEME

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

BME302

Third Semester B.E./B.Tech Degree Examination, Dec.2023/Jan.2024
Manufacturing Process

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

			M	L	C
		Module – 1			
Q.1	**a.**	Define a gating system. Explain with sketches types of gating system.	**10**	**L1**	**CO1**
	b.	Explain with a neat sketch CO_2 moulding process.	**10**	**L2**	**CO1**
		OR			
Q.2	**a.**	Define pattern and explain with a neat sketches any four pattern allowances.	**10**	**L1**	**CO1**
	b.	Explain in detail the procedure to determine grain fineness number of greens and in foundry lab.	**10**	**L2**	**CO1**
		Module – 2			
Q.3	**a.**	Explain with a neat sketch coreless induction furnace.	**10**	**L2**	**CO2**
	b.	Explain with a neat sketch cupola furnace.	**10**	**L2**	**CO2**
		OR			
Q.4	**a.**	Explain with a neat sketch centrifugal casting process.	**10**	**L2**	**CO2**
	b.	Explain with neat sketches casting defects.	**10**	**L2**	**CO2**
		Module – 3			
Q.5	**a.**	Illustrate the following metal forming processes with neat sketches : i) Bending ii) Piercing iii) Blanking.	**10**	**L2**	**CO3**
	b.	Explain the following yield criteria : i) Tresca yield criteria ii) Von-Mises yield criteria.	**10**	**L2**	**CO3**
		OR			
Q.6	**a.**	Describe compound and progressive die processes.	**10**	**L2**	**CO3**
	b.	Explain the importance of temperature in metal forming and write the differences between hot working and cold working.	**10**	**L2,1**	**CO3**
		Module – 4			
Q.7	**a.**	Explain with neat sketches types of flames produced in OXY-Acetylene welding.	**10**	**L2**	**CO4**
	b.	Explain with a neat sketch OXY-Acetylene gas welding process.	**10**	**L2**	**CO4**
		OR			
Q.8	**a.**	Explain with a neat sketch MIG welding and mention its advantages, disadvantages and applications.	**10**	**L2**	**CO4**
	b.	Explain with a neat sketch Manual metal arc welding and also mention its advantages, disadvantages and applications.	**10**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	Explain with neat sketches welding defects.	**10**	**L2**	**CO5**
	b.	Explain with a neat sketch residual stresses in welded structures.	**10**	**L2**	**CO5**
		OR			
Q.10	**a.**	Describe the following : i) Soldering ii) Brazing.	**10**	**L2**	**CO5**

CBCS SCHEME

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

BME303

Third Semester B.E./B.Tech Degree Examination, Dec.2023/Jan.2024
Material Science and Engineering

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Calculate the APF for FCC and BCC unit cell in crystal structure.	10	L3	CO1
	b.	Enumerate the type of crystal imperfections and explain briefly with a suitable sketch grain boundary and twin boundry defects.	10	L2	CO1
		OR			
Q.2	a.	Explain briefly with suitable sketches the plastic deformation by Slip and Twinning.	10	L2	CO1
	b.	Define the following terms : i) Unit cell and space lattice ii) Coordination number.	5	L2	CO1
	c.	Molybdenum has BCC and a density of 10.2×10^3 kg/m^3. Calculate its atomic radius. The atomic weight of molybdenum is 95.94gm/mol. $N_A = 6.023 \times 10^{23}$ atoms/mol.	5	L3	CO1
		Module – 2			
Q.3	a.	Draw neatly the solid solution binary phase diagram of a Ni-Cu system and explain briefly.	10	L2	CO2
	b.	State and explain briefly the Fick's 1st and 2nd law of diffusion.	10	L2	CO2
		OR			
Q.4	a.	Explain briefly with a neat sketch the eutectic system of two components completely soluble in liquid state and partially soluble in solid state.	08	L2	CO2
	b.	Draw a neat sketch of iron-carbon equilibrium diagram and show all phases on the diagram also show the three invariant reactions.	12	L2	CO2
		Module – 3			
Q.5	a.	Explain briefly mechanism of solidification with suitable sketches.	10	L2	CO3
	b.	With a suitable sketch explain normalizing heat treatment process.	10	L2	CO3
		OR			
Q.6	a.	Draw a neat labeled Time-Temperature Transformation [TTT] diagram for Eutectoid steel (0.8%C) and explain briefly.	10	L3	CO3
	b.	With a neat sketch briefly explain Aaustemperign and Martempering heat treatment process.	10	L2	CO3
		Module – 4			
Q.7	a.	With a flow chart, explain briefly the powder metallurgy process and its applications.	10	L2	CO4
	b.	Enumerate the different powder production methods, with suitable sketch explain atomization method.	10	L2	CO4
		OR			
Q.8	a.	Explain briefly thermal spray coating with suitable sketch. Mention the advantages of surface coatings and treatments.	10	L2	CO4

		Module – 5			
Q.9	**a.**	Classify engineering metals. Enumerate the types of cast iron and mention the compositions, properties and applications.	**10**	**L2**	**CO5**
	b.	With a neat sketch, explain the production of composite by : i) Filament winding process ii) Bag molding process.	**10**	**L2**	**CO5**
		OR			
Q.10	**a.**	With a suitable sketch explain the production of metal metric composite by stir casting process.	**10**	**L2**	**CO5**
	b.	What are the factors affecting the selection of materials explain briefly.	**10**	**L2**	**CO5**

* * * * *

CBCS SCHEME

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

BME304

Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024
Basic Thermodynamics

Time: 3 hrs. Max. Marks: 100

Note: **1.** ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***M : Marks , L: Bloom's level , C: Course outcomes.***
3. ***Use of thermodynamic data handbook and steam tables is permitted.***
4. ***Assume missing data suitably.***

		Module – 1	M	L	C
Q.1	a.	State Zeroth law of thermodynamics and justify how it forms the basis for temperature measurement.	05	L1	CO1
	b.	Derive an expression for P-dV work for a process in which (i) PV = C (ii) PV^n = C where C is a constant.	05	L2	CO1
	c.	The temperature scale by a certain thermometer is given by the relation t = a ln x + b where 'a' and 'b' are constants and x is the thermometric property of the fluid in the thermometer. If at ice and steam points the thermometric property is found to be 1.5 and 7.5 respectively. What will be the temperature corresponding to the thermometric property 3.5?	10	L3	CO1
		OR			
Q.2	a.	Show that thermodynamics definition for work is superior to mechanics definition.	05	L1	CO1
	b.	With a neat sketch, explain working principle of constant volume gas thermometer.	05	L2	CO1
	c.	A perfect gas is undergoing a process in which $T \alpha V^{2/5}$. Calculate the work done by the gas in going from state 1 in which the pressure is 100 bar and volume is 4 m^3 to the state 2 in which volume is 2 m^3. Also calculate the final pressure.	10	L4	CO1
		Module – 2			
Q.3	a.	State the first law of thermodynamics along with the mathematical expression for the following: (i) A closed system undergoing a cycle (ii) A closed system undergoing a change of state.	05	L1	CO2
	b.	With a neat sketch of steady flow device, write the steady flow energy equation with usual notations.	05	L1	CO2
	c.	A stationary mass of gas is compressed without friction from an initial state of 0.3 m^3 and 0.105 MPa to a final state of 0.15 m^3 and 0.105 MPa, the pressure remaining constant during the process. There is a transfer of 37.6 kJ of heat from the gas during the process. How much does the internal energy of the gas change?	10	L3	CO2
		OR			
Q.4	a.	Write the steady flow energy equation for (i) Boiler (ii) Centrifugal pump.	05	L1	CO2
	b.	Show that energy is a property of the system.	05	L2	CO2
	c.	In a certain steady flow process, 12 kg of fluid per minute enters at a pressure of 1.4 bar, density 25 kg/m^3, velocity 120 m/s and internal energy 920 kJ/kg. The fluid properties at exit are 5.6 bar, density 5 kg/m^3, velocity 180 m/s, and internal energy 720 kJ/kg. During the process, the fluid rejects 60 kJ/s of heat and rises through 60 m. Determine work done during the process in KW.	10	L4	CO2

		Module – 3			
Q.5	**a.**	Define thermal efficiency of a heat engine and COP of a refrigerator along with mathematical expressions for both. Write their schematic diagram.	**05**	**L1**	**CO3**
	b.	Define entropy and show that it is a property of the system.	**05**	**L2**	**CO3**
	c.	A reversible heat engine converts one-sixth of the heat input into work. When the temperature of the sink is reduced by 62°C, its efficiency is doubled. Find the temperature of the source and the sink.	**10**	**L4**	**CO3**
		OR			
Q.6	**a.**	State and prove Clausius theorem.	**05**	**L2**	**CO3**
	b.	Give the Kelvin-Plank and Clausius statements of the second law of thermodynamics.	**05**	**L1**	**CO3**
	c.	A lump of steel of mass 10 kg at 627°C is dropped in 100 kg of oil at 30°C. The specific heats of steel and oil are 0.5 kJ/kgK and 3.5 kJ/kgK respectively. Calculate the entropy change of steel, the oil and the universe.	**10**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	Define Available Energy (AE) and Unavailable Energy (UE). Show that unavailable energy is the product of lowest temperature of heat rejection and the change in entropy of the system during the process of supplying heat. Draw the necessary schematics and T-S diagrams.	**10**	**L4**	**CO4**
	b.	With a neat sketch, explain the working principle of separating and throttling calorimeter.	**10**	**L2**	**CO4**
		OR			
Q.8	**a.**	In a certain process, a vapor, while condensing at 420°C, transfers heat to water evaporating at 250°C. The resulting steam is used in a power cycle which rejects heat at 35°C. What is the fraction of the available energy in the heat transfer process from the vapour at 420°C that is lost due to the irreversible heat transfer at 250°C?	**10**	**L3**	**CO4**
	b.	Draw the phase equilibrium diagram for a pure substance on P-T coordinates and show the fusion curve, vaporization curve, sublimation curve, triple point and critical point.	**10**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	Write notes on: (i) Daltons law of partial pressure (ii) Amagots law of additive volumes (iii) Compressibility factor (iv) Law of corresponding states (v) Generalized compressibility chart	**10**	**L2**	**CO5**
	b.	One kg of ideal gas is heated from 50°C to 150°C. Determine: (i) Change in internal energy (ii) Change in enthalpy (iii) Change in flow energy (iv) $\overline{C}_v$ and $\overline{C}_p$ Take R = 280 kJ/kgK; γ = 1.32 for gas.	**10**	**L3**	**CO5**
		OR			
Q.10	**a.**	Derive: (i) Maxwell's equations (ii) The first and second Tds equations.	**10**	**L2**	**CO5**
	b.	Find the gas constant and apparent molar mass of a mixture of 2 kg O_2 and 3 kg N_2 given that the universal gas constant is 8314.3 J/kgK, molar mass of O_2 and N_2 are respectively 32 and 28.	**10**	**L3**	**CO5**

* * * * *

CBCS SCHEME

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

BME306A

Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024
Electric and Hybrid Vehicle Technology

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Explain the fundamental components of a hybrid drive train, distinguishing between series and parallel hybrid configurations.	10	L2	CO1
	b.	Enumerate and explain the advantages of electric and hybrid vehicles over conventional internal combustion engine vehicles.	10	L3	CO1
		OR			
Q.2	a.	Identify and discuss the limitations and challenges faced by electric and hybrid vehicles.	10	L2	CO1
	b.	Examine the challenges related to the disposal of batteries and hazardous materials used in electric and hybrid vehicles, emphasizing the environmental risks.	10	L3	CO1
		Module – 2			
Q.3	a.	Evaluate the key functionalities of a BMS and their impact on the overall efficiency and reliability of energy storage systems.	10	L3	CO2
	b.	Classify major type of rechargeable batteries considered for EV and HEV applications and evaluate the overall working principle of Li-Ion batteries with chemical reaction.	10	L2	CO2
		OR			
Q.4	a.	Classify type of fuel cells and evaluate the overall working principle of hydrogen fuel cell in production of electricity by mean of chemical reactions.	10	L3	CO2
	b.	Discuss the concept of hybridization of various energy storage devices.	10	L2	CO2
		Module – 3			
Q.5	a.	List the various types of motor. Discuss the key parameters involved in the selection and sizing of electric motors for various applications.	10	L3	CO3
	b.	Explain the working principles of permanent magnet motors drive and its characteristics.	10	L2	CO3
		OR			
Q.6	a.	Explain the working principles of brushless DC motors drive and its characteristics.	10	L2	CO3
	b.	Explain operation of the three-phase induction motor and its control characteristics.	10	L2	CO3
		Module – 4			
Q.7	a.	Explain the essential characteristics influencing the design of batteries, ultra-capacitors and fuel cells in electric vehicles.	10	L3	CO4
	b.	Illustrate the importance of aerodynamic features in EV and HEV vehicles design and their impact on overall performance.	10	L3	CO4

OR					
Q.8	a.	Explain combined effects of rolling resistance, grade resistance and acceleration force to determine the total tractive effort required for vehicle motion.	10	L3	CO4
	b.	Provide an overview of how vehicle mass considerations impact design decisions, energy consumption and overall performance.	10	L3	CO4
Module – 5					
Q.9	a.	Explain understanding of smart charging, emphasizing the interaction between the grid and the vehicle.	10	L2	CO5
	b.	Describe the concept of vehicle-to-vehicle communication systems, introducing the potential benefits and applications.	10	L2	CO5
OR					
Q.10	a.	Discuss the installation and commissioning process of battery charging stations, considering the necessary steps and requirements.	10	L2	CO5
	b.	Examine various types of connectors used in electric vehicle charging infrastructure, highlighting their differences and applications.	10	L2	CO5

* * * * *

S/ 18 IV sem. ME

CBCS SCHEME

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

18ME42

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Applied Thermodynamics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. With a neat P-V and T-S diagrams for a diesel cycle, derive an expression for air-standard efficiency in terms of compression ratio and cut-off ratio. **(10 Marks)**

b. The compression ratio of a diesel cycle is 14 and cut off ratio is 2.2. At the beginning of the cycle, air is at 0.98 bar and 100°C. Find : (i) Temperature and pressure at salient points (ii) Air standard efficiency (iii) Mean effective pressure. Represent with neat sketches of P-V and T-S. **(10 Marks)**

OR

2 a. Explain with neat diagram combustion in CI engine. **(10 Marks)**

b. A six cylinder four stroke IC engine is designed to develop 60 KW power at an average pressure of 7 bar. The bore and stroke of the engine is 70 mm and 100 mm respectively. If the engine speed is 3700 rpm, find the average misfires/min and actual power developed. **(10 Marks)**

Module-2

3 a. With neat P-V and T-S diagrams, explain the processer of Brayton cycle and derive an expression for efficiency of ideal gas turbine. **(10 Marks)**

b. Air enters compressor of an open cycle constant pressure gas turbine at a pressure of 1 bar and temperature of 20°C. The pressure of air after compression is 4 bar. The isentropic efficiencies of the compressor and turbine are 80% and 85% respectively. The air fuel ratio used is 90:1. The air flow rate is 3 kg/s. Find : (i) Power developed (ii) Thermal efficiency of the cycle. **(10 Marks)**

OR

4 a. Analyze Ram pressure ratio with respect to Mach number of a Ram jet engine for sea level conditions. **(10 Marks)**

b. A jet propulsion unit with turbo jet engine propelling with a forward speed of 1100 km/h produces 14 kN of thrust and uses 2400 kg of air per minute. Find:
(i) The relative exit jet velocity (ii) The thrust power
(iii) The propulsive power (iv) The propulsive efficiency **(10 Marks)**

Module-3

5 a. With a schematic diagram and T-S diagram, briefly explain the working of regenerative vapor cycle with open feed water heaters. Derive the thermal efficiency expression for the same. **(10 Marks)**

b. A reheat cycle operating between 30 bar and 0.04 bar pressure. The temperature of steam supplied from boiler is 450°C. The first stage of expansion taken place till the steam is dry saturated and then reheated to 450°C and then expanded in second stage. Determine:
i) Reheat pressure ii) Quality of exhaust steam
iii) Ideal cycle efficiency iv) Steam rate **(10 Marks)**

OR

6 a. With neat diagram, explain the effects of pressure and temperature on Rankine cycle performance. **(12 Marks)**

b. In a boiler house steam from a steam generator enters a turbine at 20 bar and expands to condenser pressure of 0.2 bar. Determine the Rankine cycle efficiency neglecting pump work.

(i) When steam is 85% dry at turbine inlet.
(ii) When steam is saturated at turbine inlet.
(iii) When steam is superheated at turbine inlet by 37.6°C **(08 Marks)**

Module-4

7 a. Analyse vapour compression refrigeration cycle for, (i) Heat rejected (ii) COP (iii) Compressor displacement (iv) Power consumption per TR **(10 Marks)**

b. An air refrigeration plant is to be designed according to following specifications:
Pressure at compressor inlet = 101 kPa
Pressure of air at compressor exit = 404 kPa
Temperature of air at compressor inlet = −6°C
Temperature of air at turbine inlet = 27°C
Isentropic efficiency of compressor = 85%
Isentropic efficiency of turbine = 85%
Determine:
(i) COP of the cycle
(ii) Power required to produce 1 ton of refrigeration
(iii) Air circulation rate per ton of refrigeration. **(10 Marks)**

OR

8 a. Explain the following with definition:
(i) Specific humidity
(ii) Degree of saturation
(iii) Dalton's law of partial pressures **(10 Marks)**

b. Atmospheric air at 40°C and 40% RH is to be cooled to a state of saturated air at 10°C by dehumidification. The mass flow rate of air entering the dehumidifier in 0.8 kg/s. Neglecting the pressure drop, determine: (i) Mass of water removed (ii) Quantity of heat removed. **(10 Marks)**

Module-5

9 a. Obtain an expression for work done by a reciprocating compressor with and without clearance volume. **(10 Marks)**

b. Find the power required to compress and deliver 2 kg of air per minute from 1 bar and 20°C to a delivery pressure of 7 bar when the compression is carried out in:
(i) Single stage compressor
(ii) Two stage compressor
The compression of air follows the law $PV^{1.4} = C$. Neglect clearance and assume ideal conditions for intercooler. Take R = 0.287 kJ/kg.K. **(10 Marks)**

OR

10 a. Why turbine nozzles are made divergent after the throat? **(10 Marks)**

b. Steam at a pressure of 6.85 bar and 0.9 dry expands through a nozzle having a throat area of 4.65 cm^2. The back pressure is 1.03 bar. Determine:
(i) Mass of steam flowing per minute
(ii) The diameter of month of the nozzle for maximum discharge
(iii) The final velocity of the steam **(10 Marks)**

* * * * *

CBCS SCHEME

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

18ME43

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Fluid Mechanics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define the following terms with S.I. units:
i) Specific volume
ii) Relative density, S
iii) Kinematic viscosity
iv) Compressibility, C
v) Shear stress. **(10 Marks)**

b. Dynamic viscosity of oil used for lubrication between a shaft and sleeve is 6 poise. Shaft diameter is 0.4m and rotates at 190rpm. Determine the power lost in the bearing for a sleeve length of 90mm. Thickness of oil film is 1.2mm. Determine the shear stress. **(10 Marks)**

OR

2 a. Define capillary rise. Derive as expression for capillary rise of water in a tube of diameter d. **(06 Marks)**

b. Define and derive an expression for the Pascal law of static fluid. **(06 Marks)**

c. A circular plate 3.0m diameter is immersed in water such that its greatest and least depth below the free surface are 4.0m and 1.5m respectively. Determine total force on the plate and its location. **(08 Marks)**

Module-2

3 a. Define Metacentre and centre of Buoyance. Explain conditions of equilibrium for floating bodies. **(08 Marks)**

b. A cylindrical buoy is 2m in diameter, 2.5m long and weighs 2.2 metric tones. Density of sea water is 1025kg/m^3. Check the condition of cylinder for floating. **(12 Marks)**

OR

4 a. Obtain an expression for (3) three dimensional continuity equation in Cartesian co-ordinates. **(08 Marks)**

b. Differentiate between:
i) Steady flow and unsteady flow.
ii) Rotation and Irrotational flow.
iii) Viscous and Turbulent flow. **(06 Marks)**

c. The stream function for a flow is given by $\psi = 2xy$. Determine the velocity at a point P(2, 3) and find velocity potential function. **(06 Marks)**

Module-3

5 a. Derive Bernoulli's equation for fluid flow and state the assumptions. **(08 Marks)**

b. With neat sketch, explain working of the venturimeter fitted in a pipeline. **(06 Marks)**

c. Determine the velocity and discharge of oil flow in a pipe, when the difference of mercury level in a differential u-Tube manometer connected to Pitot-tube is 100mm. Assume coefficient of pitot-tube is 0.98 and special gravity of oil is 0.80, diameter 200mm. **(06 Marks)**

OR

6 a. For viscous flow through a circular pipe derive Hagen-Poiseuille equation. **(10 Marks)**

b. For a pipeflow, due to sudden enlargement of diameter of pipe from 240mm to 480mm, kinetic head increases by 10mm. Determine the rate of water flow in lit/sec. **(10 Marks)**

Module-4

7 a. Explain following terms:
i) Boundary layer
ii) Displacement thickness
iii) Momentum thickness
iv) Lift, drag. **(10 Marks)**

b. A man descends to the ground from an aeroplane with the help of a parachute which is hemispherical having a diameter of 4.0m against the resistance of air with a uniform velocity of 25m/sec. Find the weight of the man if the weight of parachute is 9.81N. Assume $C_D = 0.6$ and density of air is $1.25 kg/m^3$. **(10 Marks)**

OR

8 a. List four Non-Dimensional Numbers used in model similitude and obtain relations for the numbers. **(10 Marks)**

b. The frictional torque T of a disc of diameter D rotating at a speed 'N' in a fluid of viscosity 'M' and density 'ρ' in a turbulent flow is given by $T = \rho N^2 D^5 f\left(\frac{u\ell}{\rho N D^2}\right)$. Use dimensional analysis method. **(10 Marks)**

Module-5

9 a. Derive relation for velocity of sound in compressible fluid flow at adiabatic conditions. **(10 Marks)**

b. Explain the terms:
i) Subsonic flow ii) Supersonic flow. **(05 Marks)**

c. A projectile travels in air of pressure $10.104 N/cm^2$ at 10°C with speed of 1500km/hour. Determine Mach number and Mach angle. Assume K = 1.4, R = 287J/kg K. **(05 Marks)**

OR

10 a. Obtain an expression for stagnation pressure in compressible fluid flow. **(10 Marks)**

b. Explain the necessity of CFD and list the applications of CFD. **(10 Marks)**

* * * * *

CBCS SCHEME

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

18ME44

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Kinematics of Machines

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. What is quick return motion? Explain with neat sketch crank and slotted lever mechanism. **(10 Marks)**

b. Draw a neat sketch of peaucellier's mechanism. Explain with proof how the tracing point describes a straight line path. **(10 Marks)**

OR

2 a. Define the following:
i) Link ii) Kinematic chain iii) Degree of freedom iv) Inversion. **(08 Marks)**

b. Explain with a neat sketch:
i) Beam engine mechanism
ii) Geneva wheel mechanism
iii) Toggle mechanism. **(12 Marks)**

Module-2

3 For a four bar mechanism shown in Fig.Q.3 determine the acceleration of C and angular acceleration of link 3 when crank 2 rotates at 20 radians per second. **(20 Marks)**

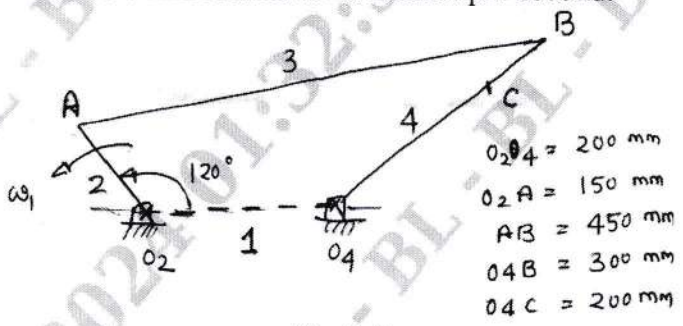


Fig.Q.3

OR

4 a. Define velocity of rubbing and spherical motion. **(04 Marks)**

b. State and prove Kennedy's theorem. **(06 Marks)**

c. In a slider crank mechanism shown in Fig.Q.4(c) the crank OA = 300mm and connecting rod AB = 1200mm. The crank OA is turned 30° from inner dead centre. Locate all the instantaneous centres. If the crank rotates at 15rad/sec clockwise find i) Velocity of slider B ii) Angular velocity of connecting rod AB. **(10 Marks)**

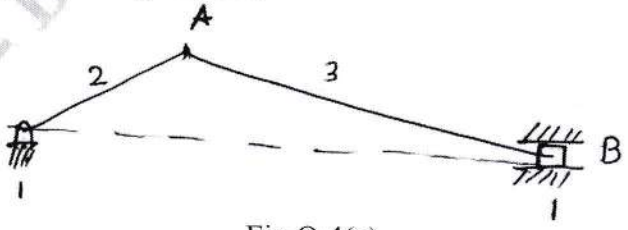


Fig.Q.4(c)

Module-3

5 The crank of an engine is 200mm long and the ratio of connecting rod length to crank radius is 4. Determine the acceleration of piston when the crank has turned through 45° from the inner dead centre position and moving towards centre at 240rpm (CCW) direction by complex Algebra analysis. **(20 Marks)**

OR

6 a. Derive the expression for Freudensteion's equation for four bar mechanism. **(15 Marks)**

b. Explain function generation for four bar mechanism. **(05 Marks)**

Module-4

7 Draw the cam profile for cam with roller reciprocating follower. The axis of follower passes through the axis of cam. Particulars of cam and follower are the following:
Roller diameter = 20mm
Minimum radius of cam = 25mm
Total lift = 30mm
The cam has to lift the follower with SHM during 180° of cam rotation. Then allow the follower to drop suddenly half way and further return with uniform velocity during the remaining 180° of cam rotation. The cam rotates in anticlockwise direction. **(20 Marks)**

OR

8 A vertical spindle supplied with a plane horizontal face at its lower end is actuated by a cam keyed to a uniformly rotating shaft. The spindle is raised through a distance of 30mm in one fourth, remains at rest in 1/4 is lowered in 1/3 and remains at rest for the remainder of a complete revolution. Draw the profile assuming the least radius of cam profile as 25mm and that the spindle moves with uniform acceleration and retardation on both during ascent and descent. However during descent declaration period is half the acceleration period. The axis of spindle passes through cam axis the cam rotates in anticlockwise direction. **(20 Marks)**

Module-5

9 a. Explain interference in gears. Discuss the methods of avoiding interference in gear drives. **(10 Marks)**

b. A pair of gears·40 and 30 teeths respectively are of 25° involute form addendum = 5mm module = 2.5mm if the smaller wheel is the driver and rotates at 1500rpm find the velocity of sliding at the point of engagement, at pitch point and the point of dis engagement, length of path of contact and length of arc of contact. **(10 Marks)**

OR

10 a. What do you mean by epicyclic gear train and also find the train valve by algebraic method. **(04 Marks)**

b. In an epicyclic gear train the internal wheels A, B and the compound wheel C and D rotate independently about the axis "0". The wheels E and F rotate on a pin fixed to the arm G. E gears with A and C and F gears with B and D. All the wheels have same pitch and the number of teeth on E and F are 18, C = 28, D = 26.
i) Sketch the arrangement ii) Number of teeth on A and B iii) If arm G makes 150rpm CW and A is fixed find speed of B iv) If arm G makes 150rpm CW and wheel A makes 15rpm CCW find speed of B. **(16 Marks)**

* * * * *

CBCS SCHEME

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

18ME45B/18MEB405

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Metal Casting and Welding

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define metal casting and briefly explain steps involved in casting process. **(10 Marks)**

b. What is pattern? List its types and explain any two with neat sketch. **(10 Marks)**

OR

2 a. List the types of molding machines and explain any one with neat sketch. **(10 Marks)**

b. What is core? Why they are required and explain methods of making cores. **(10 Marks)**

Module-2

3 a. Write a note on:
(i) Resistance furnace.
(ii) Electric Arc Furnace. **(10 Marks)**

b. With necessary sketch, explain working principle of cupola furnace along with chemical reactions. **(10 Marks)**

OR

4 a. Write a note on the following :
(i) Centrifugal casting
(ii) Thixo casting. **(12 Marks)**

b. Explain continuous casting process with neat sketch and list its advantages. **(08 Marks)**

Module-3

5 a. Define solidification and what are its variables. Explain solidification. **(10 Marks)**

b. Explain casting defects, causes features and remedies. **(10 Marks)**

OR

6 a. Explain the following :
(i) Fluxing and Flushing
(ii) Grain refining **(08 Marks)**

b. With neat sketch, explain Stir-casting procedure, uses, advantages and limitations. **(12 Marks)**

Module-4

7 a. Define welding. Give its classification, application, advantages and limitations. **(10 Marks)**

b. Explain flux shielded metal arc welding and list its advantages and limitations. **(10 Marks)**

OR

8 a. What are the resistance welding principles? Explain projection welding. **(10 Marks)**

b. Write a note on:
(i) Friction welding.
(ii) Thermit welding. **(10 Marks)**

Module-5

9 a. Write a note on:
(i) Structure of welds.
(ii) Heat affected zone and parameters affecting HAZ. **(10 Marks)**

b. Explain welding defects, detection causes and remedy. **(10 Marks)**

OR

10 a. Explain Oxy-Acetylene welding process with neat sketch. **(08 Marks)**

b. Write a note on :
(i) Radiography Inspection.
(ii) Holography Inspection. **(12 Marks)**

* * * * *

CBCS SCHEME

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

18ME46B/18MEB406

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Mechanical Measurements and Metrology

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define Metrology. What are the objectives of metrology? **(08 Marks)**

b. Define material standard and wave length standard. Explain subdivision standards. **(06 Marks)**

c. List and draw the slip gauges to be wrong together to produce an overall dimension of : i) 92.3565 ii) 62.306. Using M112 slip gauge set. **(06 Marks)**

OR

2 a. With a neat sketch, explain the working principle of sine bar. **(06 Marks)**

b. With a neat sketch, explain the working of autocollimator. **(06 Marks)**

c. Four length bars A, B, C, D of approximately 250mm each are to be calibrated with a calibrated standard meter bar which is 0.0008mm less than a meter. It is also found that, bar B is 0.0002mm longer than bar A, bar C is 0.0004mm longer than A, and bar D is 0.0001mm shorter than bar A the length of all four bars put together is 0.0003mm longer than the calibrated standard meter. Determine the actual dimensions of each bar. **(08 Marks)**

Module-2

3 a. Describe in detail the need of hole basis system and shaft basis system with sketches. **(10 Marks)**

b. Determine the dimensions of the shaft and hole for a $28H_8g_6$ and sketch the fit. Diameter 28 falls in the diameter range of 18-30mm. Fundamental deviation for 'd' shaft is $-2.5D^{0.34}$, IT8 = 25i, IT6 = 10i, $I = 0.45\sqrt[3]{D} + 0.001D$ microns. **(10 Marks)**

OR

4 a. Give classification of comparators and explain with neat sketch Johansson Mikrokaktor. **(10 Marks)**

b. With a neat sketch, explain the construction and principle of solex pneumatic comparator. **(10 Marks)**

Module-3

5 a. With a neat sketch, explain the various terms used in the screw thread. **(10 Marks)**

b. With the help of neat sketch, explain the method of determining the chordal thickness of a gear tooth using gear tooth verneir calliper. **(10 Marks)**

OR

6 a. Derive an expression to find the effective diameter of screwthread using two-wire method. **(10 Marks)**

b. Sketch and explain composite error testing of spur gears. **(10 Marks)**

Module-4

7 a. Describe the generalized measurement system with a block diagram. **(10 Marks)**

b. Distinguish between :

i) Primary and Secondary transducer

ii) Active and Passive transducer. **(10 Marks)**

OR

8 a. Sketch and explain any one type of electrical transducer. Give advantages of electrical transducers. **(10 Marks)**

b. Describe the Cathode ray oscilloscope with a neat sketch. **(10 Marks)**

Module-5

9 a. With a neat sketch, explain the working principle of Prony brake dynamometer. What are its limitations? **(10 Marks)**

b. Sketch and explain the working of Pirani thermal conductivity gauge. Give advantages of Pirani thermal conductivity gauges. **(10 Marks)**

OR

10 a. Define strain gauge. With a neat sketch, explain wheat stone bridge circuit. **(10 Marks)**

b. Explain the construction and working principle of optical pysometer. **(10 Marks)**

* * * * *

CBCS SCHEME

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

18MAETDIP41

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Additional Mathematics – II

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Find the rank of $\begin{bmatrix} 1 & 2 & 3 & 2 \\ 2 & 3 & 5 & 1 \\ 1 & 3 & 4 & 5 \end{bmatrix}$. **(06 Marks)**

b. Solve by using Gauss elimination method. Given $x+y+z=9$, $2x+y-z=0$ and $2x+5y+7z=52$. **(07 Marks)**

c. Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$. **(07 Marks)**

OR

2 a. Find the rank of the matrix $\begin{bmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{bmatrix}$. **(06 Marks)**

b. Find the eigen values and eigen vectors of the matrix $A = \begin{bmatrix} -19 & 7 \\ -42 & 16 \end{bmatrix}$. **(07 Marks)**

c. Find the values of λ and μ so that the equations $x+y+z=6$, $x+2y+3z=10$ and $x+2y+\lambda z=\mu$ have (i) no solution (ii) a unique solution (iii) an infinite number of solutions. **(07 Marks)**

Module-2

3 a. Using Newton Raphson method, find the real root of the equation $3x=\cos x+1$, correct to four decimal places. Take $x = 0.6$ as the initial approximation. **(06 Marks)**

b. Given f(40) = 184, f(50) = 204, f(60) = 226, f(70) = 250, f(80) = 276, f(90) = 304. Find f(85) using Newton's backward difference interpolation formula. **(07 Marks)**

c. Evaluate $\int_0^6 \frac{1}{1+x^2}dx$ by using Simpson's $\frac{1}{3}$ rule by considering 6 subintervals. **(07 Marks)**

OR

4 a. Using Regula Falsi method, find a real root of the equation $x\log_{10}x-1.2=0$ which lies in (2, 3). Carryout 3 iterations. **(06 Marks)**

b. Using the following data, find y when x = 1. Given,

x	3	4	5	6	7	8	9
y	4.8	8.4	14.5	23.6	36.2	52.8	73.9

Use Newton's forward interpolation formula. **(07 Marks)**

c. Evaluate $\int_4^{5.2} \log x\,dx$ by using Weddle's rules taking 6 subintervals. **(07 Marks)**

Module-3

5 a. Solve $(D^3 + 3D^2 + 3D + 1)y = 0$. **(06 Marks)**

b. Solve $(D^2 + 7D + 12)y = \cosh x$. **(07 Marks)**

c. Solve $(D^2 - 4D + 4)y = \cos 2x$. **(07 Marks)**

OR

6 a. Solve $(4D^4 - 8D^3 - 7D^2 + 11D + 6)y = 0$. **(06 Marks)**

b. Solve $(D^2 - 6D + 9)y = 6e^{3x}$. **(07 Marks)**

c. Solve $(D^2 - 5D + 6)y = \sin 3x$. **(07 Marks)**

Module-4

7 a. Form the partial differential equation by eliminating arbitrary functions from $z = y^2 + 2f\left(\frac{1}{x} + \log y\right)$. **(06 Marks)**

b. Form the PDE by eliminating arbitrary constants a and b from the relation $(x-a)^2 + (y-b)^2 + z^2 = k^2$. **(07 Marks)**

c. Solve $\frac{\partial^2 z}{\partial x^2} = a^2 z$, given that when $x = 0$, $z = 0$ and $\frac{\partial z}{\partial x} = a \sin y$. **(07 Marks)**

OR

8 a. Form a partial differential equation by eliminating the arbitrary function from $\phi(x + y + z,\ x^2 + y^2 + z^2) = 0$. **(06 Marks)**

b. Form a partial differential equation by eliminating arbitrary function from $z = f(x + ct) + g(x - ct)$. **(07 Marks)**

c. Solve $\frac{\partial^2 z}{\partial x \partial y} = \sin x \sin y$ by direct integration. Given that $\frac{\partial z}{\partial y} = -2 \sin y$ when $x = 0$ and $z = 0$ when y is an odd multiple of $\frac{\pi}{2}$. **(07 Marks)**

Module-5

9 a. Given $P(A) = \frac{1}{4}$, $P(B) = \frac{1}{3}$ and $P(A \cup B) = \frac{1}{2}$. Find $P(A/B)$, $P(B/A)$, $P(A \cap \overline{B})$ and $P(A/\overline{B})$. **(06 Marks)**

b. The probability that three students A, B, C, solve a problem is $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$ respectively. If the problem is simultaneously assigned to all of them, what is the probability that the problem is solved? **(07 Marks)**

c. State and prove Baye's theorem. **(07 Marks)**

OR

10 a. If A and B are independent events, show that $\overline{A}$ and $\overline{B}$ are also independent. **(06 Marks)**

b. The probability that a team wins a match is $\frac{3}{5}$. If this team plays 3 matches in a tournament, what is the probability that the team wins (i) atleast one match (ii) all matches. **(07 Marks)**

c. An office has 4 secretaries handling respectively 20%, 60% and 15% and 5% of the files of all government reports. The probability that they misfile such reports is respectively 0.05, 0.1 and 0.05. Find the probability that a misfiled report can be blamed on first secretary? **(07 Marks)**

* * * * *

(C) 21 IV Sem ME

CBCS SCHEME

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

21ME42

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Machining Science & Jigs & Fixtures

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. List the operations carried out on drilling machine and explain any 2 operation with neat sketch. **(08 Marks)**

b. Explain the step by step procedure of taper turning operation carried out and lathe machine. **(06 Marks)**

c. Define machining process and explain the classification of material removal process. **(06 Marks)**

OR

2 a. Explain with neat sketch, the construction of horizontal milling machine (column × knee type). **(08 Marks)**

b. Explain the step by step procedure of machining a rectangular slot of 10 mm wide × 5 mm depth on a rectangular block using shaping machine. **(06 Marks)**

c. With neat sketch, explain the following operation :
(i) Straddle milling
(ii) Reaming
(iii) Plain turning **(06 Marks)**

Module-2

3 a. Sketch and explain the tool geometry of a single point cutting tool and highlight the significance of different angles. **(08 Marks)**

b. Explain the various types of cutting fluids used in metal cutting and state the properties of cutting fluids. **(06 Marks)**

c. List out the differences between orthogonal and oblique cutting. **(06 Marks)**

OR

4 a. Briefly explain the different types of chips produced during metal cutting with neat sketches. **(08 Marks)**

b. Explain the steps involved in cutting force measurement with dynamometers for tuning operation. **(06 Marks)**

c. A Seamless tubing 35 mm outside diameter is turned orthogonally on a lathe. The following data is available. Rake angle = 35°, Cutting speed = 15 m/min, Feed = 0.10 mm/rev, Length of continuous chip in one revolution = 50.72 mm. Cutting force = 200 N, Feed force = 80 N. Calculate the co-efficient of friction, shear plane angle, velocity of chip along tool face and chip thickness. **(06 Marks)**

Module-3

5 a. What is machinability? List and explain the variables that affect the tool life. **(08 Marks)**

b. Explain with neat sketch, the principal of lapping. **(06 Marks)**

c. Explain with neat sketch, the principal of honing. **(06 Marks)**

OR

6 a. Explain with a neat sketch, the various forms of tool wear found in the cutting tools. **(08 Marks)**

b. Write a short notes on the following :
   (i) Electroplating
   (ii) Powder coating.
   (iii) Liquid coating. **(12 Marks)**

Module-4

7 a. With neat labeled sketch, explain the working of Abrasive water jet machining along with its application. **(10 Marks)**

b. Explain the process parameters of USM and list the advantages, limitation of it. **(10 Marks)**

OR

8 a. With neat labeled sketch, explain the working principal of electrical discharge machining. List the various in EDM process and explain any one of them process parameters. **(10 Marks)**

b. Explain with neat sketch the working of ultrasonic assisted electric discharge machining along with its advantages. **(10 Marks)**

Module-5

9 a. With neat sketch, explain template jig and leaf jig. **(10 Marks)**

b. State the factors to be considered for the design of jigs and fixtures. **(05 Marks)**

c. List the difference between jigs and fixtures. **(05 Marks)**

OR

10 a. What is jig and fixture? List and explain the essential features of jigs and fixtures. **(10 Marks)**

b. List the different types of fixtures and with neat sketch explain any one type of fixture in detail. **(10 Marks)**

* * * * *

CBCS SCHEME

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

21ME43

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Fluid Mechanics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define the following terms :
(i) Absolute pressure
(ii) Gauge pressure
(iii) Differential manometers
(iv) Buoyancy
(v) Meta-centre. **(05 Marks)**

b. The left limb of a mercury U-tube manometer is open to atmosphere and the right limb is connected to a pipe carrying water under pressure. The centre of the pipe is at the level of the free surface of mercury. Find the difference in level of mercury limbs of U-tube, if the absolute pressure of water in the pipe is 14.5 m of water, atmospheric pressure is 760 mm of Hg. **(05 Marks)**

c. Derive an expression for the depth of centre of pressure from free surface of liquid of an inclined plane surface submerged in the liquid. **(10 Marks)**

OR

2 a. Define the equation of continuity. Derive the continuity equation for the three dimensional flow in Cartesian co-ordinates. **(10 Marks)**

b. If for a two-dimensional potential flow, the velocity potential is given by : $\phi = 4x(3y-4)$, determine the velocity at the point (2, 3). Determine also the value of stream function ψ at the point (2, 3). **(08 Marks)**

c. State Reynold's transport theorem. **(02 Marks)**

Module-2

3 a. Derive Euler's equation of motion along a stream line for an ideal fluid stating clearly the assumptions. Explain how this is integrated to get Bernoulli's equation along a stream line. **(10 Marks)**

b. A pipe 5 m long is inclined at an angle of 15° with the horizontal. The smaller section of the pipe which is at a lower level is of 80 mm diameter and the larger section of the pipe is of 240 mm diameter. Determine the difference of pressure between the two sections, if the pipe is uniformly tapering and the velocity of water at the smaller section is 1 m/s. **(06 Marks)**

c. A jet of water of diameter 100 mm strikes a curved plate at its centre with a velocity of 15 m/s. The curved plate is moving with a velocity of 7 m/s in the direction of the jet. The jet is deflected through an angle of 150°. Assuming the plate smooth find :
(i) Force exerted on the plate in the direction of the jet.
(ii) Power of the jet. **(04 Marks)**

OR

4 a. Define an orifice-meter. Prove that the discharge through an orifice-meter is given by the relation $Q = C_d \frac{a_0 a_1}{\sqrt{a_1^2 - a_0^2}} \times \sqrt{2gh}$. **(10 Marks)**

b. Water flows over a rectangular notch 1 m wide with a head of 15 cm and afterwards passes through a triangular (V notch) of 90°. Taking C_d for the rectangular and V-notch as 0.62 and 0.59 respectively. Find the head over the triangular notch. **(06 Marks)**

c. With a neat sketch, explain Rota meter. **(04 Marks)**

Module-3

5 a. Prove that the maximum velocity in a circular pipe for viscous flow is equal to two times the average velocity of the flow. Also derive Hagen Poiseuille's formula. **(10 Marks)**

b. Determine :

(i) The pressure gradient,

(ii) The shear stress at the two horizontal plates.

(iii) The discharge per metre width for Laminar flow of oil, with a maximum velocity of 2 m/s between two plates which are 150 mm apart. Given $\mu = 2.5$ N-S/m^2. **(06 Marks)**

c. The external and internal diameters of a collar bearing are 200 mm and 150 mm respectively. Between the collar surface and the bearing, an oil film of thickness 0.25 mm and of viscosity 0.09 N-S/m^2 is maintained. Find the torque and the power lost in overcoming the viscous resistance of the oil when the shaft is running at 250 rpm. **(04 Marks)**

OR

6 a. Derive Darcy-Weisbach equation for loss of head due to friction in pipes. **(08 Marks)**

b. A horizontal pipe line 50 m long is connected to a reservoir at one end and discharges freely in to the atmosphere at the other end. For the first 25 m length from the reservoir the pipe has a diameter of 15 cm and it has a square entrance at the reservoir. The remaining 25 m length of pipe has a diameter of 30 cm. The junction of the two pipes is in the form of a sudden expansion. The 15 cm pipe has a gate valve ($K = 0.2$) in fully open condition. If the height of the water surface in the tank is 10 m above the center line of the pipe, estimate the discharge in the pipe by considering the Darcy-Weisbach friction factor $f = 0.02$ for both the pipes. (Include all minor losses in the calculations). **(08 Marks)**

c. Two tanks are connected with the help of two pipes in series. The lengths of the pipes are 1000 m and 800 m where as the diameters are 400 mm and 200 mm respectively. The co-efficient of friction for both the pipes is 0.008. The difference of water level in the two tanks is 15 m. Find the rate of flow of water through the pipes. Considering all losses. **(04 Marks)**

Module-4

7 a. Define the terms : (i) Lift (ii) Drag. **(04 Marks)**

b. Obtain an expression for the lift produced on a rotating cylinder placed in a uniform flow field such that the axis of the cylinder is perpendicular to the direction of flow. **(10 Marks)**

c. A Jet plane which weighs 19620 N has a wing area of 25 m^2. It is flying at a speed of 200 km/hour. When the engine develops 588.6 kW, 70% of this power is used to overcome the drag resistance of the wing. Calculate the co-efficient of lift and co-efficient of drag for the wing. Taken density of air as 1.25 kg/m^3. **(06 Marks)**

OR

8 a. Using Buckingham's π-theorem, show that the velocity through a circular orifice is given by $V = \sqrt{2gH}\phi\left[\frac{D}{H}, \frac{\mu}{\rho VH}\right]$, where H is the head causing flow, D is the diameter of the orifice, μ is co-efficient of viscosity, ρ is the mass density and g is the acceleration due to gravity. **(10 Marks)**

b. Explain the different types of similarities that must exist between a prototype and its model. **(06 Marks)**

c. Define the following non-dimensiional numbers :
(i) Reynold's number
(ii) Mach's number.
What are their significances for fluid flow problems? **(04 Marks)**

Module-5

9 a. Obtain an expression for velocity of the sound wave in a compressible fluid in terms of change of pressure and change of density. **(10 Marks)**

b. A projectile travels in air of pressure 8.829 N/cm^2 at -10° C at a speed of 1200 km/hr. Find the mach number and mach angle. Take K = 1.4 and R = 287 J/kgK. **(05 Marks)**

c. Explain Normal and Oblique shocks. **(05 Marks)**

OR

10 a. Obtain an expression for stagnation pressure of a compressible fluid in terms of approaching mach number and pressure. **(10 Marks)**

b. Find the velocity of air flowing at the outlet of a nozzle, fitted to a large vessel which contains air at a pressure of 294.3 N/cm^2(abs.) and at a temperature of 30°C. The pressure at the outlet of the nozzle is 137.34 N/cm^2(abs.). Take K = 1.4 and R = 287 J/kgK. **(04 Marks)**

c. Define computational fluid dynamics. Mention the applications and limitations of CFD. **(06 Marks)**

* * * * *

CBCS SCHEME

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

21ME44

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Mechanics of Materials

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define the following terms:
i) True stress
ii) Poisson's ratio
iii) Stiffness
iv) Volumetric strain. **(04 Marks)**

b. Derive the expression for the total elongation of a tapered circular bar cross-section of diameter 'd_1' and 'd_2' when subjected to an axial load 'P'. **(08 Marks)**

c. A steel bolt of 16mm diameter passes centrally through a copper tube of internal diameter 20mm and external diameter 30mm. The length of the whole assembly is 500mm. After tight fitting of the assembly, the nut is over tightened by quarter $\left(\frac{1}{4}\text{th}\right)$ of a turn. What are the stresses introduced in bolt and tube. If pitch of nut is 2mm. Take E_{steel} = 200GPa and E_{copper} = 120GPa. **(08 Marks)**

OR

2 a. State Hooke's law. Sketch the typical stress-strain curve for mild-steel specimen during tension test. Show the salient points on the graph and briefly explain them. **(10 Marks)**

b. Define Young's modulus and rigidity modulus. Derive relation between Young's modulus (E) and rigidity modulus (G). **(10 Marks)**

Module-2

3 a. Derive the expressions for normal and tangential stress on a plane inclined at 'θ' to the plane of stress in x-direction in a general two dimensional stress system and show that sum of normal stress in any two mutually perpendicular directions is constant. **(12 Marks)**

b. The state of stress in a two dimensionally stressed body is shown in Fig.Q.3(b). Determine graphically (by drawing Mohr's circle), the principal stresses, principal planes, maximum shear stress and its planes. **(08 Marks)**

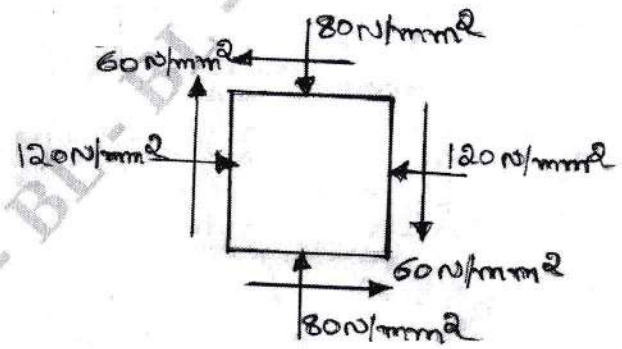


Fig.Q.3(b)

OR

4 The state of stress at a point in a strained material is shown in Fig.Q.4(a). Determine:
i) The direction of the principal planes.
ii) The magnitude of principal stresses.
iii) The magnitude of the maximum shear stress and its direction.
iv) Draw Mohr's circle and verify the results obtained analytically. **(20 Marks)**

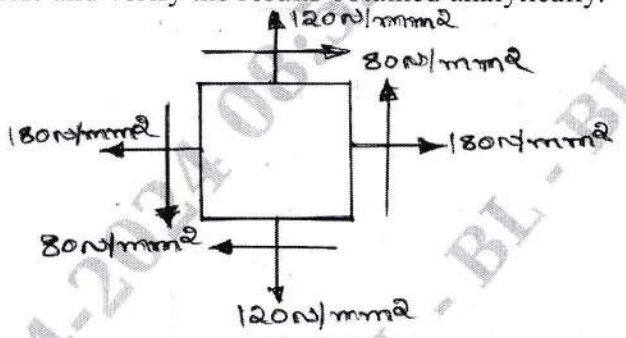


Fig.Q.4

Module-3

5 a. Define a beam. Explain with simple sketches, different types of beams. **(06 Marks)**

b. Draw the shear force and bending moment diagrams for the overhanging beam, carrying uniformly distributed load of 2kN/m over the entire length and a point load of 2kN as shown in Fig.Q.5(b). Locate the point of contra-flexure. **(14 Marks)**

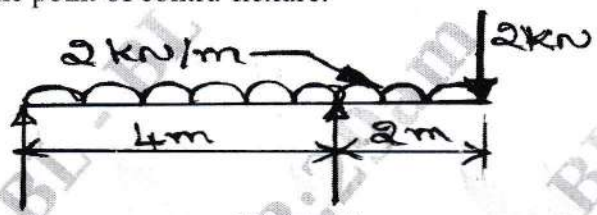


Fig.Q.5(b)

OR

6 Draw shear force and bending moment diagrams for the beam shown in Fig.Q.6. Locate the point of contraflexure. **(20 Marks)**

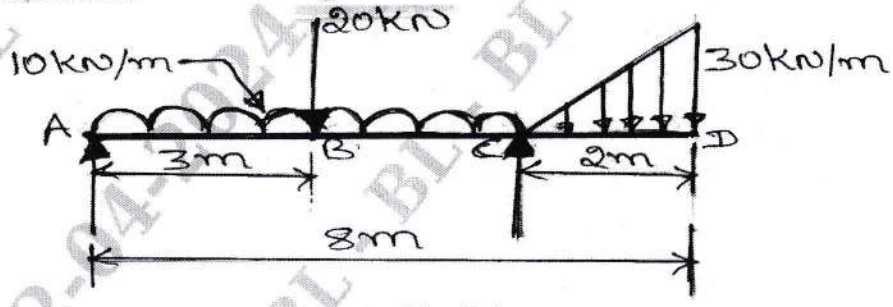


Fig.Q.6

Module-4

7 a. Prove the relation $\frac{M}{I}=\frac{\sigma}{Y}=\frac{E}{R}$ with usual notations. **(10 Marks)**

b. Prove that a hollow shaft is stronger and stiffer than the solid shaft of the same material, length and weight. **(10 Marks)**

OR

8 a. Derive the torsional equation for a circular shaft with usual notations. State the assumptions made. **(10 Marks)**

b. A hollow steel shaft transmits 392kW of power at 150rpm. The total angle of twist in a length of 3m of shaft is 2.5°. Find the inner and outer diameters of the shaft. If the permissible shear stress is 90MPa. Take G = 85GPa. **(10 Marks)**

Module-5

9 a. Differentiate between thin and thick cylinders. **(02 Marks)**

b. Derive an expression for circumferential and longitudinal stress for a thin cylinder subjected to an internal pressure 'P'. **(08 Marks)**

c. Derive the expression for radial and hoop stresses (Lame's equations) for a thick cylinder. **(10 Marks)**

OR

10 a. Derive an expression for Euler's buckling load in a column when both ends are fixed. **(10 Marks)**

b. Derive an expression for a critical load in a column subjected to compressive load, when both ends are hinged. **(10 Marks)**

* * * * *

CBCS SCHEME

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

21BE45

Fourth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Biology for Engineers

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain the structure and classification of carbohydrates, focusing on monosaccharide, disaccharides and polysaccharides. Discuss their biomedical importance of carbohydrates. **(10 Marks)**

b. Explain the construction, properties and importance of cellulose-based water filters. **(05 Marks)**

c. Discuss the properties, engineering applications and environmental impact of pHA and PLA as bioplastics. **(05 Marks)**

OR

2 a. Discuss the importance and potential applications of DNA and vaccines using rabies as an example. Explain how DNA vaccines work. **(10 Marks)**

b. Explain the properties, advantages and engineering applications of RNA vaccines, specifically for COVID-19. **(05 Marks)**

c. Discuss the benefits and uses of plant-based proteins as alternatives to animal-based proteins. **(05 Marks)**

Module-2

3 a. Compare and write architecture of the human brain as a CPU system with that based on their characteristics. **(10 Marks)**

b. What is EEG? Write the application of EEG. **(05 Marks)**

c. Eye act as camera. Explain with diagram. **(05 Marks)**

OR

4 a. Describe the architecture of the heart as a pump system. Discuss the function of each chamber. **(10 Marks)**

b. Discuss the reasons for blockages in blood vessels and their implications for cardiovascular health. **(05 Marks)**

c. Discuss the different shapes, materials, coating and expansion mechanisms used in stent design. **(05 Marks)**

Module-3

5 a. Explain the architecture of the lungs as a purification system. Discuss the different parts of the respiratory system and their role in filtering harmful substances and facilitating gas exchange. **(10 Marks)**

b. Discuss the principle and working of spirometry as a diagnostic test for evaluating lung function. Explain how spirometry results can be interpreted and used in the diagnosis of lung conditions. **(05 Marks)**

c. Explain the concept of abnormal lung physiology. Focusing on Chronic Abstractive Pulmonary Disease (COPD) as an example. **(05 Marks)**

OR

6 a. Describe the architecture of the kidney and its functional units. Known as nephrons. Discuss the role of each component of the nephron in the filtration, reabsorption and scoretion processes. (10 Marks)

b. Discuss the types of muscle and contract of muscle. (05 Marks)

c. Explore the bioengineering solutions being developed for osteoporosis. (05 Marks)

Module-4

7 a. Explain the working principle of ultrasonography and discuss its advantages and limitations in medical imaging. (10 Marks)

b. Discuss the history of technological echolocation. (05 Marks)

c. Explain components of bionic leaf. (05 Marks)

OR

8 a. Compare between Birds and Aircrafts with GPS technology for Navigation and discuss. (10 Marks)

b. Discuss the principle of super hydrophobic surfaces. (05 Marks)

c. Discuss the materials and examples of self cleaning surface. (05 Marks)

Module-5

9 a. Elucidate the difference between 3D printer and Bioprinter. (10 Marks)

b. Discuss technological importance of 3D printing of Human Ear. (05 Marks)

c. Discuss materials used in 3D printing of Bone. (05 Marks)

OR

10 a. Evaluate the importance of 3D printing in the food industry. (10 Marks)

b. Discuss the technological importance of self healing bio concrete. (05 Marks)

c. Evaluate the advantages of bioremediation and biomining. (05 Marks)

* * * * *

21 V sem ME

CBCS SCHEME

USN | | | | | | | | | | **21ME51**

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Theory of Machines

Time: 3 hrs. Max. Marks: 100

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

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

Module-1

1 a. Define the following terms :
(i) Kinematic pair. (ii) Kinematic chain.
(iii) Mechanism (iv) Degree of freedom.
(iv) Inversion. **(05 Marks)**

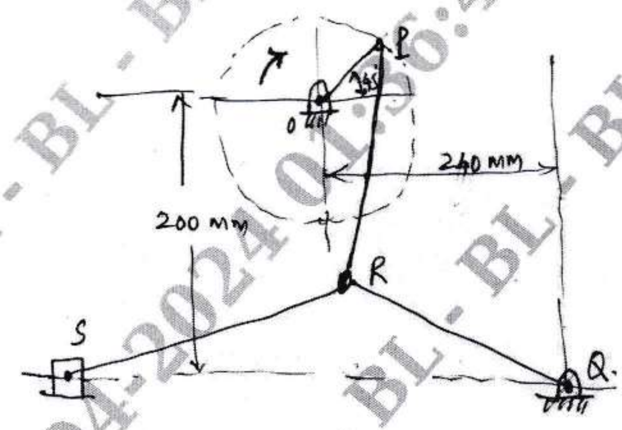
b. With neat sketch, explain any three inversions of four-bar kinematic chain. **(09 Marks)**

c. A four bar chain mechanism ABCD is made up of four links, pin jointed at the ends. AD is fixed line which is 120 mm long. The links AB, BC and CD are 60 mm, 80 mm and 80 mm respectively. At a certain instant, the link AB makes an angle of 60° with the link AD. If the link AB rotates at a uniform speed of 10 rpm clockwise, determine angular velocity of the link BC and CD. **(06 Marks)**

OR

2 a. Distinguish between machine and structure. (Any four) **(04 Marks)**

b. The Fig. Q2 (b) shows a toggle mechanism, Crank OP rotates at a uniform speed of 120 rpm in clockwise direction. Determine the velocity and acceleration of the slider S. The length of the various links are OP = 80 mm, PR = 180 mm, QR = 240 mm and SR = 270 mm. **(08 Marks)**



OP = 80 mm
PR = 180 mm
QR = 240 mm
SR = 270 mm

Fig. Q2 (b)

c. Using complex algebra, determine the velocity and acceleration of the piston, angular acceleration of the connecting rod of a reciprocating engine. If the crank length is 50 mm, connecting rod 200 mm, crank speed is constant at 3000 rpm and crank angle is 30°. **(08 Marks)**

Module-2

3 a. Explain the static equilibrium of two forces, three forces and member with two forces and a torque. **(06 Marks)**

b. State D'Alemberts principle. When a crank 45° from inner dead centre on the down stroke. The effective steam pressure on the piston of a vertical steam engine is 2.5 bar. The diameter of the cylinder = 0.75 m, stroke of the piston = 0.50 m and the length of the connecting rod = 1 m. Determine the torque on the crank shaft, if the engine runs at 350 rpm and the mass of reciprocating parts is 200 kg. **(06 Marks)**

56

c. What is fly wheel? The turning moment diagram for a multicylinder engine has been drawn to a scale of 1 mm = 600 N-m vertically and 1 mm = 3° horizontally. The intercepted areas between the output torque curve and the mean resistance line taken in order from one end are as follows : +52, −124, +92, −140, +85, −72 and +107 mm^2.
When the engine is running at a speed of 600 rpm, if the total fluctuation of speed is not to exceed +1.5% of the mean. Find the necessary mass of the flywheel of radius 0.5 m. **(08 Marks)**

OR

4 a. For the mechanism shown in Fig. Q4 (a), find the required input torque for static equilibrium. The lengths OA and AB are 250 mm and 650 mm respectively. F = 500 N.

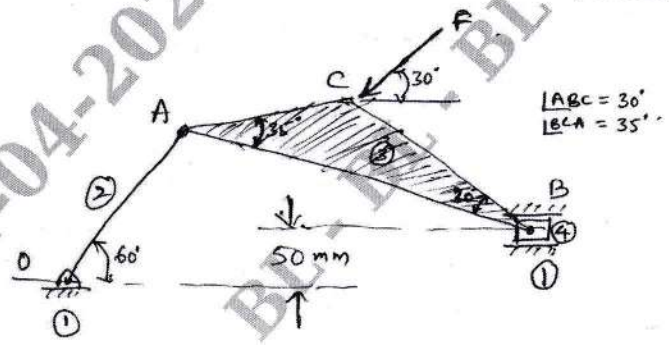


Fig. Q4 (a) **(10 Marks)**

b. The crank pin circle radius of a horizontal engine is 300 mm. The mass of reciprocating parts is 250 kg. when the crank has travelled 60° for IDC. The difference between the driving and the back pressure is 0.35 N/mm^2. The connecting rod length between centres is 1.2 m and the cylinder bore is 0.5 m. If the engine runs at 250 rpm and if the effect of piston rod diameter is neglected, calculate : (i) Pressure on the slide bars (ii) Thrust in the connecting rod (iii) Tangential force on the crank pin and (iv) Turning moment on the crank shaft. **(10 Marks)**

Module-3

5 a. State law of gearing. Derive an expression for the minimum number of teeth on the pinion in order to avoid interference in involute gear teeth when it meshed with wheel. **(08 Marks)**

b. Two mating gears with module pitch 6 mm have 20 and 50 teeth of pressure angle 30° and addendum 6 mm. Determine the number of pairs of teeth in contact. **(05 Marks)**

c. What is a Gear Train? With neat sketch, explain different types of gear trains. **(07 Marks)**

OR

6 a. With neat sketch, explain spur gear terminology. **(06 Marks)**

b. Two 20° involute spur gears mesh externally to give a velocity ratio of 3. Module is 3 mm and the addendum is equal to 1.1 times the module. If the pinion rotates at 120 rpm ; determine ; Minimum number of teeth on each wheel to avoid interference. **(04 Marks)**

c. An epicyclic gear train consists of a sun wheel (s) a stationary internal gear (E) and the three identical planet wheel (P) carried on a star shaped planet carrier (C). The sizes of different toothed wheels are such that the planet carrier C rotates at $\frac{1}{5}$ of the speed of the sun wheel. The minimum number of teeth on any wheel is 16. The driving torque on the sun wheel is 100 N-m. Determine :

(i) Number of teeth on different wheels of train.

(ii) Torque necessary to keep the internal gear stationary. **(10 Marks)**

Module-4

7 a. Three masses of 8 kg, 12 kg and 15 kg attached at radial distance of 80 mm, 100 mm and 60 mm respectively to a disc on a shaft are in static balance. Determine the angular positions of masses 12 kg and 15 kg relative to 8 kg mass. **(06 Marks)**

b. Explain why only part of unbalanced forces due to reciprocating masses is balanced by revolving masses. **(06 Marks)**

c. What is a governor? Derive an expression for the equilibrium speed of a porter governor. **(08 Marks)**

OR

8 a. A rotating shaft carries four masses 1, 2, 3 and 4 which are radially attached to it. The mass centers are 30 mm, 38 mm, 40 mm and 35 mm respectively from the axis of rotation. The masses 1, 3 and 4 are 7.5, 5 and 4 kg respectively. The axial distance between the planes 1 and 2 is 400 mm and between 2 and 3 is 500 mm. The masses 1 and 3 are at right angles to each other. Find for complete balance

(i) Angle between 1, 2 and 1, 4
(ii) Axial distance between 3 and 4.
(iii) Magnitude of mass 2. **(10 Marks)**

b. The radius of rotation of the balls of a Hartnell Governor in 8 cm at the minimum speed of 300 rpm. Neglecting gravity effect determine the speed after the sleeve is lifted by 6 cm ; also determine the initial compression of the spring, governor effort and power. The particulars of the governor are, length of ball arm = 15 cm, Length of sleeve arm = 10 cm, Mass of each ball = 4 kg and stiffness = 25000 N/m. **(10 Marks)**

Module-5

9 a. Define the terms : (i) Damping (ii) Damping ratio (iii) Stiffness of the spring (iv) Logarithmic decrement. **(06 Marks)**

b. Determine the natural frequency of the simple pendulum by using Newton's method. Neglecting the mass of rod. **(04 Marks)**

c. Determine the critical speed when an automobile trailer is travelling over a road with sinusoidal profile of wavelength 15 meter as shown in Fig. Q9 (c) and amplitude of 75 mm. The spring of the automobile are compressed 0.125 m under its own weight. Also determine the amplitude of vibration at 50 kmph.

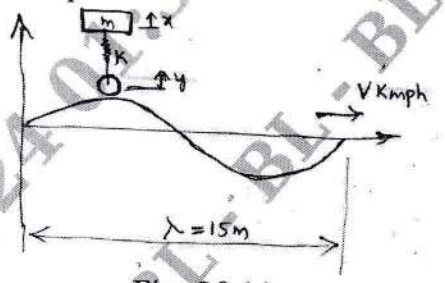


Fig. Q9 (c) **(10 Marks)**

OR

10 a. Derive an expression for steady state solution with viscous damping due to harmonic force. **(10 Marks)**

b. Determine the damped natural frequency for the system shown in Fig. Q10 (b). Also if m = 1.5 kg, K = 4900 N/m, a = 10 cm and b = 13 cm, determine the critical damping co-efficient 'C' for the system. **(10 Marks)**

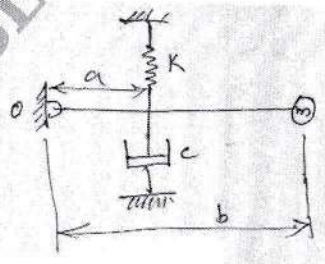


Fig. Q10 (b)

CBCS SCHEME

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

21ME52

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Thermo-Fluids Engineering

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. With suitable formulae, explain Morse test for measuring frictional power in an IC engine. **(05 Marks)**

b. What are the parameters to be considered while framing heat balance sheet for an IC engine? **(05 Marks)**

c. The following data refers to a four stroke diesel engine :
Cylinder diameter = 200 mm,
Stroke = 300 mm, Speed = 300 rpm,
Effective brake load = 500 kg,
Mean circumference of the brake drum = 400 mm,
Mean effective pressure = 6 bar,
Diesel consumption = 0.1 lt/min,
Calorific value = 43900 kJ/kg,
Specific gravity = 0.78.
Find :
(i) Brake power
(ii) Indicated power
(iii) Frictional power
(iv) Mechanical efficiency
(v) Indicated thermal efficiency. **(10 Marks)**

OR

2 a. Explain the procedure of conducting experiment to evaluate the performance of a reciprocating 2 stage air compressor. **(06 Marks)**

b. With the help of PV diagram, derive an expression for the volumetric efficiency in terms of clearance ratio for a 2 stage reciprocating air compressor. **(06 Marks)**

c. A double acting air compressor of 18 cm diameter and 120 cm stroke runs at 120 rpm and operates between 1 bar and 10 bar, the lower temperature being 15°C. Estimate the power, final temperature and temperature rise, if the compression index = 1.3. **(08 Marks)**

Module-2

3 a. With a neat sketch, explain vapor absorption refrigerator. **(06 Marks)**

b. Mention a few properties of a good refrigerant. **(04 Marks)**

c. An air refrigerator was designed to produce 80 tons of refrigeration, with air entering the compressor at 8°C. The air was cooled after compression in a cooler to 27°C. It was observed that the actual power required was 20% more than theoretical power with an air circulation rate of 2 kg/s. Determine (i) The theoretical COP (ii) Actual COP (iii) Power required to run the compressor. Assume r = 1.4, C_P = 1.005 kJ/kgK for air and the cycle is ideal. **(10 Marks)**

OR

4 a. Define the terms :
(i) Dew point temperature.
(ii) Dry bulb temperature.
(iii) Wet bulb temperature.
(iv) Humidity ratio.
(v) Relative humidity. **(10 Marks)**

b. An auditorium of 150 seating capacity is conditioned for the following specifications:
Outdoor conditions = 40 °C DBT and 20 °C WBT,
Required indoor conditions = 20 °C DBT and 60% RH.
Amount of outdoor air supplied = 0.4 m^3/min per person.
If the required condition is achieved first by adiabatic humidification and then by cooling.
Calculate : (i) Capacity of the cooling coil in tones
(ii) The capacity of the humidifier in kg/min. **(10 Marks)**

Module-3

5 a. With a neat sketch, explain various parts of turbomachine. **(06 Marks)**

b. With the proper velocity triangles derive an expression for alternate form of Euler's turbine equation. **(06 Marks)**

c. The velocity of steam in a De-Laval turbine at the inlet is 1200 m/s. The nozzle angle at the inlet is 22° and rotor blades are equiangular. Assuming relative velocities of the fluid at the inlet and exit to be equal and tangential speed of the rotor is 400 m/s. Determine
(i) The blade angles at the inlet and exit.
(ii) Power developed if mass flow rate is 1 kg/s
(iii) Tangential force exerted on the blade ring
(iv) Utilization factor. **(08 Marks)**

OR

6 a. Compare turbomachines and positive displacement machines. **(06 Marks)**

b. With a neat sketch, explain the working of a gear pump. **(06 Marks)**

c. In a radial inward flow turbine, the runner outer diameter is 75 cm and the inner diameter is 50 cm. The runner speed is 400 rpm. Water enters the runner at a velocity of 15 m/s at an angle of 15° to wheel tangent at inlet. The flow is radial at exit with a velocity of 5 m/s. Find the blade angles at inlet and exit. Also determine the power output for flow rate of 1.5 m^3/s, degree of reaction and utilization factor. **(08 Marks)**

Module-4

7 a. Explain the experimental procedure to evaluate the efficiency of a Pelton wheel. **(06 Marks)**

b. Derive an expression for hydraulic efficiency of a Pelton turbine. **(06 Marks)**

c. The external and internal diameters of inward flow reaction turbine are 1.2 m and 0.6 m respectively. The head on turbine is 22 m and velocity of flow through the turbine is constant and is equal to 2.5 m/s. The guide blade angle is 10° and runner vanes are radial at inlet. If the discharge at outlet are radial. Determine
(i) Speed of turbine
(ii) Vane angle at outlet of runner.
(iii) Velocity triangles at inlet and exit
(iv) Hydraulic efficiency. **08 Marks)**

OR

8 a. Derive expression for theoretical head capacity relationship of a centrifugal pump for different vane angles. **(08 Marks)**

b. With a sketch, show different parts of a centrifugal pump. **(04 Marks)**

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

Module-5

9 a. Briefly explain the terms in relation with a centrifugal compressor,

(i) Diffuser

(ii) Slip factor. **(06 Marks)**

b. Derive an expression for pressure ratio of a centrifugal compressor. **(06 Marks)**

c. A centrifugal compressor delivers 30 kg/s of air with a total head pressure ratio of 4 : 1. The speed of the compressor is 12000 rpm, inlet total temperature is 15°C, stagnation pressure at inlet 1 bar, slip factor is 0.9, power input factor is 1.04, efficiency 80%. Calculate the outer diameter of the impeller. **(08 Marks)**

OR

10 a. Derive an expression for maximum blade efficiency for impulse turbine. **(10 Marks)**

b. A simple impulse turbine has a mean blade speed of 200 m/s. The nozzles are inclined at 20° to the plane of rotation of the blades. The steam velocity from nozzles is 600 m/s. The turbine uses 3500 kg/hr of steam. The absolute velocity at exit is along the axis of the turbine. Determine, (i) Inlet and exit angles of blades (ii) Power output of turbine (iii) Diagram efficiency. **(10 Marks)**

* * * * *

CBCS SCHEME

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

21ME53

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Finite Elements Analysis

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain briefly the general steps involved in finite element method. **(10 Marks)**

b. Explain convergence criteria and discritization process in F.E.M. **(10 Marks)**

OR

2 a. Explain 1D, 2D and 3D elements in F.EM. **(10 Marks)**

b. Explain plane stress and plane strain conditions. **(10 Marks)**

Module-2

3 a. Derive shape functions for 1D Quadratic bar elements in natural coordinates. **(10 Marks)**

b. Derive shape functions for constant strain triangle, in natural coordinates. **(10 Marks)**

OR

4 A stepped bar as shown in Fig Q4. Determine the nodal displacement and stresses at each node. Take $E = 2 \times 10^5$ N/mm^2.

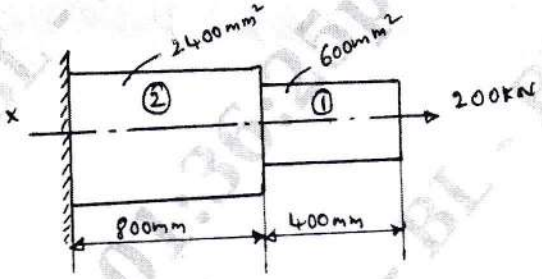


Fig Q4 **(20 Marks)**

Module-3

5 a. Derive H_1 and H_2 Hermite shape functions for beam elements. **(10 Marks)**

b. A cantilever beam subjected to point load of 250kN as shown in Fig Q5(b). Determine the deflection at free end Take E = 200GPa, $I = 4 \times 10^6$mm^4.

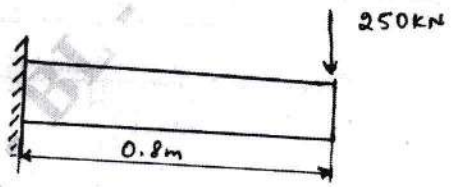


Fig Q5(b) **(10 Marks)**

OR

6 a. Derive stiffness matrix equation for torsion of shaft. **(10 Marks)**

b. A solid stepped bar of circular cross section as shown in Fig Q6(b), is subjected to a torque of 1kN-m at its free end and a torque of 3kN-m at its change in C/S. Determine the angle of twist in the bar. Take $E = 2 \times 10^5$MPa, $G = 7 \times 10^4$MPa.

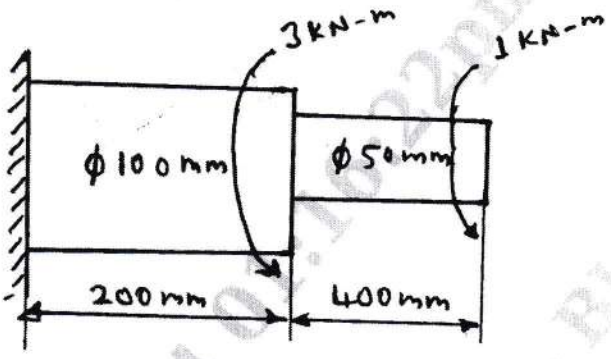


Fig Q6(b) **(10 Marks)**

Module-4

7 Determine the temperature distribution is the wall using 1D heat elements. Give $K_1 = 25W/m^oC$, $K_2 = 35W/m^oC$, $h = 30w/m^2C$, $T_\infty = 900^oC$, A = unit area.

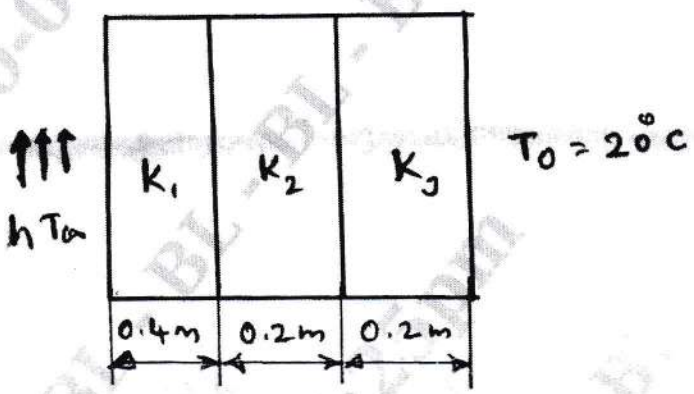


Fig Q7 **(20 Marks)**

OR

8 For smooth pipe of variable c/s shown in Fig Q8. Determine potential at junctions, Velocities in each section of pipe and volumetric flow rate. Potential at left end $P_1 = 10m^2/s$, right end $P_4 = 1m^2/sec$, fluid flow through pipe $K_x = 1$.

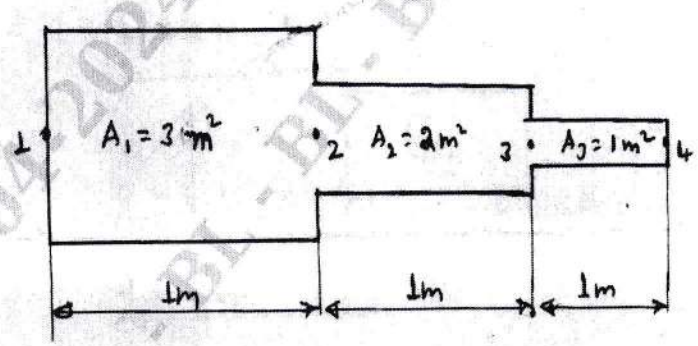


Fig Q8 **(20 Marks)**

Module-5

9 a. Derive stiffness, matrix of axisymmetric bodes with triangular elements. **(10 Marks)**

b. Evaluate nodal forces used to replace the linearly varying surface traction shown in Fig Q9(b)

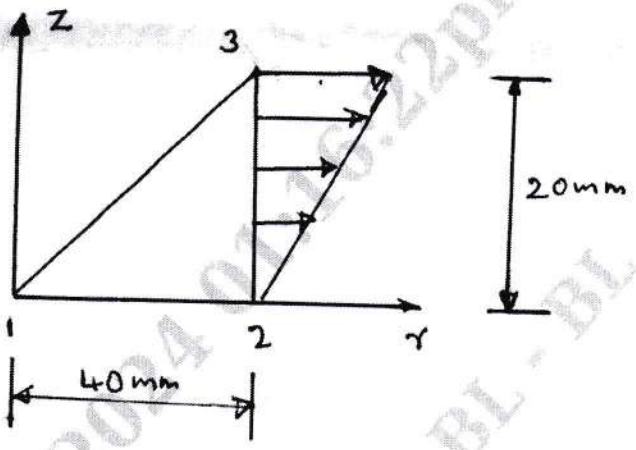


Fig Q9(b)

(10 Marks)

OR

10 Find Eigen values and Eigen vectors for stepped bar when it is subjected to axial vibration with fixed free end condition as shown in Fig Q10.

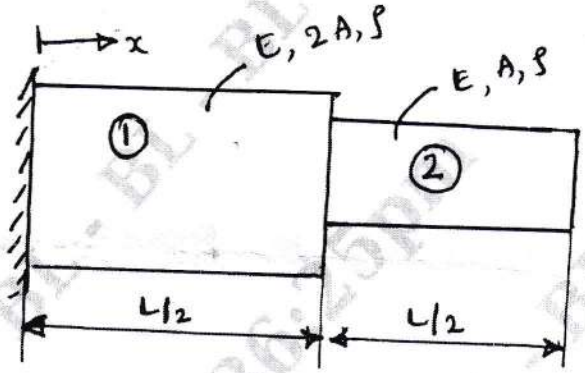


Fig Q10

(20 Marks)

* * * * *

CBCS SCHEME

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

21ME54

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Modern Mobility and Automotive Mechanics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. List the components of Automotive Engine. Mention their function and materials used for manufacturing. **(10 Marks)**

b. With neat sketch, explain the working of thermosymptom cooling system. **(10 Marks)**

OR

2 a. Explain dry sump lubrication system, with help of neat sketch. **(10 Marks)**

b. Sketch and explain Electronic [Battery] Ignition system. **(10 Marks)**

Module-2

3 a. With the help of neat sketch, explain Multi – Plate Clutch. **(10 Marks)**

b. With neat sketch, explain Torque converter. **(10 Marks)**

OR

4 a. Explain with neat sketch about the working of synchromesh gear box. **(10 Marks)**

b. With a neat sketch, explain the working principle of Air suspension system. **(10 Marks)**

Module-3

5 a. What is Steering geometry? Define the following : i) Camber ii) Caster iii) King – pin inclination iv) Toe – in Toe - out. **(10 Marks)**

b. What is ABS? Explain with appropriate sketch. **(10 Marks)**

OR

6 a. Explain the working of Power steering. **(10 Marks)**

b. Explain about the safety terms : i) Air bags ii) Seat belt iii) Defogger and spoiler iv) Fire safety measures. **(10 Marks)**

Module-4

7 a. What is Pollution? Explain the exhaust gas pollutants effects on Environment. **(10 Marks)**

b. Explain about the IC engine fuels and its advantages and disadvantages. **(10 Marks)**

OR

8 a. What is CNG vehicles? Explain its operation , advantages and disadvantages. **(10 Marks)**

b. With the layout of electric hybrid vehicles, explain its operation and function of transmission and control system. **(10 Marks)**

Module-5

9 a. Explain the principle of Electric vehicles of 4 wheels. **(10 Marks)**

b. What is Motor? Explain different types of motor and construction and working of any one. **(10 Marks)**

OR

10 a. Explain the construction and working of : i) lead batteries ii) sodium based batteries. **(10 Marks)**

b. What re requirements of battery charging? How fire safety measuring in EV vehicles. **(10 Marks)**

CBCS SCHEME

21CIV57

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

Question Paper Version : C

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan. 2024
Environmental Studies

Time: 1 hr.] [Max. Marks: 50

INSTRUCTIONS TO THE CANDIDATES

1. Answer all the **fifty** questions, each question carries one mark.
2. Use only **Black ball point pen** for writing / darkening the circles.
3. **For each question, after selecting your answer, darken the appropriate circle corresponding to the same question number on the OMR sheet.**
4. Darkening two circles for the same question makes the answer invalid.
5. **Damaging/overwriting, using whiteners** on the **OMR** sheets are strictly prohibited.

---

1 According to Biomedical Waste (Management and Handling) Rules 1998, waste should not be stored beyond _____
a) 12 hours b) 48 hours c) 72 hours d) 96 hours

2 Pyrolysis is an _____ process
a) Exothermic b) Endothermic c) Both a and b d) Neither a and b

3 Chloroflurocarbons are
a) Nontoxic b) Flammable c) Corrosive d) Odorous

4 Which of the following is an air pollutant
a) Carbon dioxide b) Oxygen c) Nitrogen d) Particulate matter

5 Urbanization is
a) Local environmental issue
b) Nation environmental issue
c) Both a and b
d) Not at all an issue

6 Earth day is held every year on :
a) June 5th b) November 23rd c) April 22nd d) January 26th

7 The term hotspot was introduced by –
a) Norman Myere b) Jacob Von Verkul
c) A.G. Transley d) Ernst Haeckel

8 In an Ecosyste, the energy flow is always
a) Always unidirectional
b) Always bidirectional
c) In any direction
d) Always down directional

9 Which of the following is considered as an alternate fuel
a) CNG b) Kerosene c) Coal d) Petrol

10 Nuclear power plant in Karnataka is located at
a) Bhadravati b) Sandur c) Raichur d) Kaiga

11 Biodiversity is a measure of variation at the _____ level
a) Genetic b) Species c) Ecosystem d) All of these

12 World Environment Day is celebrated on _____
a) 5th May b) 5th June c) 18th June d) 16th August

13 Mining means
a) To conserve minerals b) To check pollution
c) To extract minerals and ores d) None of these

14 Direct conversion of solar energy is attained by
a) Solar Photo volcanic system
b) Solar diesel hybrid system
c) Solar thermal system
d) Solar air heater

15 What % of its geographical area of a country should be under forest cover
a) 23% b) 43% c) 13% d) 33%

16 Hazardous Waste Management Act was enacted in India in the year
a) 1988 b) 1989 c) 1990 d) 1991

17 Which of these following elements is the case of e-waste?
a) Cadmium b) Beryllium c) Lead d) All of these

18 Remote sensing techniques make use of the properties of _____emitted, reflected or diffracted by the sensed objects
a) Electric waves b) Sound waves
c) Electromagnetic waves d) Wind waves

19 The altitudinal distance of a geostationary satellite from the earth is about
a) 26,000km b) 30,000km c) 36,000km d) 44,000km

20 Montreal protocol is related to the
a) Food security b) Global warming
c) Sustainable development d) Ozone layer depletion

21 Disaster management includes _____
a) Mitigation b) Reconstruction c) Rehabilitation d) All of these

22 What is the health effects of fluoride in drinking waster
a) Arthritis b) Diarrhea c) Anemia d) All of these

23 What is the permissible range of pH for drinking water as per Indian standards
a) 6 – 9 b) 6 – 8.5 c) 6.5 – 8.5 d) 6 5 – 7.5

24 The infiltration of water into the subsurface is the
a) Influent b) Effluent c) Discharge d) Recharge

25 Environmental (Protection Act) was enacted in the year
a) 1986 b) 1992 c) 1984 d) 1974

26 What is the full form of NGO
a) Non-Governmental Organization
b) Non-Governance Organizations
c) No- Governance Organizations
d) Null – Governmental organizations

27 The primary cause of acid rain around the world is
a) CFC b) SO_2 c) CO d) O_3

28 Bhopal Gas Tragedy caused due to leakage of
a) Methyl ISO Cyanate (MIC) b) Sulphur dioxide
c) Mustered gas d) Methane

29 Deforestation can
a) Increase the rainfall b) Increase soil fertility
c) Introduce silt in the river d) None of these

30 The word Environment is derived from
a) Greek b) French c) Spanish d) English

31 GIS uses the information from which of the following sources
a) Non-Spatial Information System
b) Spatial Information System
c) Global Information System
d) Position Information System

32 EIA can be expanded as
a) Environment and Industrial Act
b) Environmental and Impact Activities
c) Environmental Impact Assessment
d) Environmental Impact Activity

33 ISO 14000 standards deals with
a) Pollution management b) Risk management
c) Environmental management d) None of these

34 Which of the following represents India in ISO
a) PFRDA b) FSSAI c) BIS d) BCCI

35 Which of the following is having high population density
a) India b) China c) USA d) Western Europe

36 Environment education is targeted to
a) General public
b) Professional social groups
c) Technical and Scientists
d) All of the above

37 Discharge of municipal waste cause
a) Depletion of dissolved oxygen
b) Destroy aquatic life
c) Impair biological activity
d) All of the above

38 _____ is are referred to a Earth's lungs
a) Forests b) Carbon cycle c) Water sources d) Miner

39 Solid waste is best managed through
a) Incineration b) Open dumping c) Sanitary landfill d) Composting

40 Love canal tragedy is attributed to
a) Soil pollution b) Hazardous waste c) Air pollution d) None of these

41 The main cause of damage to Taj Mahal is _____
a) Water pollution b) Soil pollution c) Acid rain d) Fog

42 Reducing the amount of future climate change is called.
a) Mitigation b) Geo-engineering c) Adaptation d) None of these

43 Ozone layer is at a height of _____ above the Earth's surface
a) 19 to 48m b) 19 to 480m c) 19 to 48km d) 190 to 480km

44 Which ministry is mainly responsible for research and development in renewable energy sources such as wind, power small hydro, biogas and solar power
a) Human Resource Development
b) Agriculture and Famous welfare
c) Ministry of new and Renewable energy
d) Health and Family welfare

45 The OTEC is an energy technology that converts
a) Energy in large fides of ocean to generate electricity
b) Energy in ocean waves to generate electricity
c) Energy in ocean due to thermal gradient to generate electricity
d) Energy in the fast moving ocean currents to generate electricity

46 In a Lake, phytoplankton grow in abundance in
a) Littoral zone b) Limnetic zone c) Profundal zone d) Benthic region

47 The prescribed limits of noise in residential area during day is
a) 55dB b) 45dB c) 60dB d) 50dB

48 The maximum allowable concentration of fluorides in drinking water
a) 3mg/L b) 2mg/L c) 2.5mg/L d) 1.5mg/L

49 The color code of plastic bag for disposing microbial laboratory culture waste
a) Red b) Black c) Blue d) White

50 The hazardous pollutant released from batteries is
a) Arsenic b) Cobalt c) Barium d) Cadmium

* * * * *

(c) 18 Yscm ME

CBCS SCHEME

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

18ME51

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Management and Economics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. What is management and illustrate the roles of manager in an organization? **(08 Marks)**
b. Summarize the levels of management. **(06 Marks)**
c. Differentiate between management and administration. **(06 Marks)**

OR

2 a. Discuss the importance and purpose of planning. **(06 Marks)**
b. Elaborate the steps involved in planning. **(10 Marks)**
c. Mention the different types of plans. **(04 Marks)**

Module-2

3 a. What is organization and mention the principles of organization? **(06 Marks)**
b. Enumerate the process of recruitment and selection process. **(08 Marks)**
c. List the different types of organization and discuss briefly anyone of the organization structure. **(06 Marks)**

OR

4 a. Narrate the Maslow's hierarchy of needs and McGregor's theory of x and y. **(08 Marks)**
b. Differentiate centralization and decentralization. **(06 Marks)**
c. Elaborately discuss the steps involved in controlling process. **(06 Marks)**

Module-3

5 a. Differentiate between :
i) Intuition and analysis
ii) Tactics and strategy. **(06 Marks)**
b. Explain the scientific approach of problem solving and decision making. **(08 Marks)**
c. Explain the law of demand and supply with suitable example. **(06 Marks)**

OR

6 a. Define the law of returns and explain the three phases of Law of return. **(08 Marks)**
b. Explain how cash flow diagram is helpful to the decision maker and draw CFD from borrowers and lenders point of view. **(06 Marks)**
c. Find the effective interest rate if the rate of interest is 6%. When compounded :
i) Yearly ii) Biannually iii) Quarterly iv) monthly. **(06 Marks)**

Module-4

7 a. Illustrate the following :
   i) Ownership life or service life
   ii) Accounting life
   iii) Economic life. **(06 Marks)**

b. State and explain the condition for worth comparison method. **(06 Marks)**

c. Two holiday cottages are under considerations compare the present worth of the cost of 24 years service, at an interest rate if 5 percent, when neither cottage has a realize salvage value.

Particulars	Cottage – 1	Cottage – 2
First cost (Rs.)	4,500	10,000
Estimated life (years)	12	24
Annual maintenance cost (Rs.)	1000	720

(08 Marks)

OR

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

b. Explain the pay back comparison method. **(04 Marks)**

c. Following are the estimates of three alternative investments made on 3 different machines in an industry. Find out which machine has the fastest payback period.

	Particular	Machine A	Machine B	Machine C
1	Initial investment (Rs.)	30,000	38,000	42,000
2	Annual reception (Rs.)	20,000	23,500	26,000
3	Annual expenditure (Rs.)	5,500	6,500	7,000
4	Economic life	4 years	4 years	4 years

(08 Marks)

Module-5

9 a. Explain how selling price is fixed for a job, giving all the components of cost, with suitable example. **(12 Marks)**

b. MICO factory produces 500 spark plugs a day involving direct material costs of Rs.40,000 direct labour cost of Rs.35,000 and factory overheads of Rs.10,000. Assuming a profit of 15% of the selling price and selling overheads to be 30% of the factory cost, calculate the selling price of one spark plug. **(08 Marks)**

OR

10 a. What is deprivation? List the different methods of determining depreciation. **(04 Marks)**

b. Explain the causes of depreciation. **(10 Marks)**

c. A student has bought moped whose first cost is Rs. 10,000 with an estimated life of 8 years. The estimated salvage value of the moped at the end of its lifetime is Rs. 2,000. Determine the depreciation amount and book value at the end of various years using SYD method of depreciation. Also find the book at the end of 10^{th} year as a specific period. **(06 Marks)**

* * * * *

CBCS SCHEME

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

18ME52

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Design of Machine Elements – I

Time: 3 hrs. Max. Marks: 100

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

Module-1

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

b. Explain the following :
(i) Bi-axial stress system.
(ii) Tri-axial stress system.
(iii) Principal stresses and Principal plane. **(05 Marks)**

c. At a point in a stressed body, the stresses act are shown in Fig. Q1 (c). Determine the value of
(i) Normal and tangential stress on a plane inclined at 45° with vertical.
(ii) The principal stresses.
(iii) The orientation of principal stresses.
(iv) The max. shear stress and its direction.

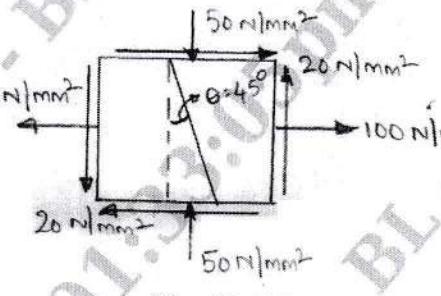


Fig. Q1 (c) **(10 Marks)**

OR

2 a. State and explain following theories of failure :
(i) Max.normal stress theory.
(ii) Max.shear stress theory.
(iii) Distortion energy theory. **(10 Marks)**

b. Find the thickness of a flat bar as shown in Fig.Q2 (b) subjected to axial load of 40 kN. Material has yield stress of 200 MPa. Assume FoS = 2.5.

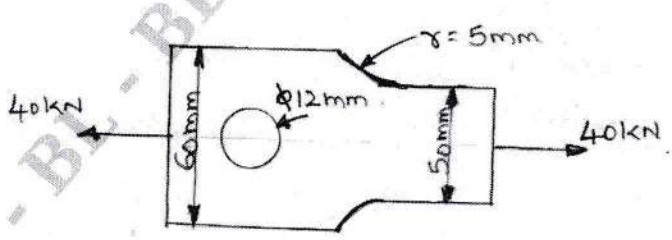


Fig. Q2 (b) **(10 Marks)**

Module-2

3 a. Derive an expression for impact stress induced in a member subjected to axial load. **(10 Marks)**

b. A 5 kg block is dropped from a height of 200 mm onto a beam shown in Fig. Q3 (b). The material has an allowable yield stress of 50 MPa. Determine the dimensions of rectangle section whose depth is 1.5 times the width. Take E = 70 MPa.

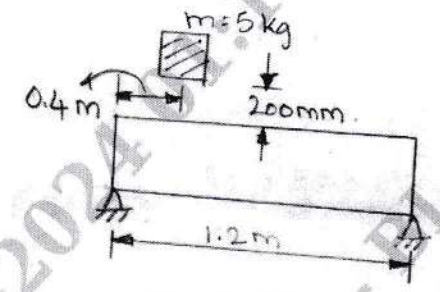


Fig. Q3 (b) **(10 Marks)**

OR

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

b. Determine the max. load for a simply supported beam cyclically loaded as shown in Fig. Q4 (b). The beam material has ultimate strength $\sigma_u = 700$ MPa, yield strength $\sigma_y = 520$ MPa and fatigue strength in reversed bending $\sigma_{-1} = 320$ MPa. Use FoS = 1.25. The load, size and surface correction factors are 1, 0.75 and 0.9 respectively.

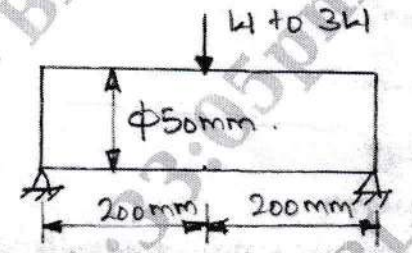


Fig. Q4 (b) **(14 Marks)**

Module-3

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

OR

6 a. Find the dimensions of the steel tapered key to transmit 20 kW at 1800 rpm. Allowable shear and compressive stresses are 80 MPa and 170 MPa respectively. Also calculate the axial force required to drive the key. **(10 Marks)**

b. Design a flange coupling to connect a shaft to a motor with following specifications. Take pump output 3000 litres/min, total head 20 m, pump speed = 600 rpm, $\eta = 70\%$. Select C-40 steel (Allowable shear stress = 82.15 MPa) for shaft, C-35 for key (Allowable shear stress = 76 MPa). Assume allowable shear stress in cast iron flange is 15 MPa. **(10 Marks)**

Module-4

7 a. With a neat sketch, Caulking and Fullering. **(10 Marks)**

b. An eccentrically loaded weld is as shown in Fig. Q7 (b). Determine the size of the weld required.

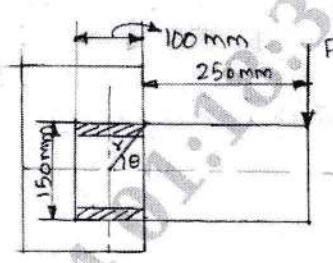


Fig.Q7 (b) **(10 Marks)**

OR

8 a. Design a double riveted-double row chain riveting with equal width cover plates, with butt joint with 2 cover plates for the longitudinal seam of a boiler shell, 1.5 m diameter subjected to a steam pressure of 0.95 N/mm^2. Assume required efficiency of 75%, take allowable tensile stress in plate as 90 N/mm^2, allowable compressive stress is 140 N/mm^2, allowable shear stress is 56 N/mm^2. **(10 Marks)**

b. A bracket supporting load P is welded to a plate by a four fillet welds of size 6 mm. What is the max. load that may be carried by the joint shown in Fig. Q8 (b) if the stress in the joint is 96 MPa.

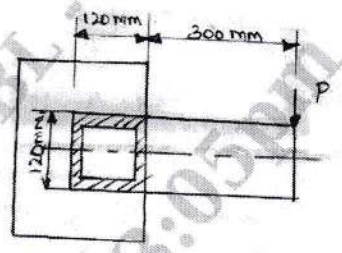


Fig. Q8 (b) **(10 Marks)**

Module-5

9 a. Design a socket and spigot cotter joint to connect two rods subjected to a tensile load of 120 kN, the permissible stresses for joint may be taken as 100 MPa in tension, 60 MPa in shear and 120 MPa in crushing. **(10 Marks)**

b. Derive an expression for torque required to raise the load for square threaded screw with usual notations. **(10 Marks)**

OR

10 a. Design a knuckle joint for a tie rod of circular cross section to sustain a max. pull of 70 kN, the ultimate tensile strength of a rod is 450 MPa, the ultimate crushing and shear strength of the pin material is 510 MPa and 396 MPa respectively. Take FoS = 6. **(10 Marks)**

b. A weight of 250 kN is raised at a speed of 6 m/min by two screw rods with square threads of 50×8 mm cut on them. Determine

(i) Torque required to raise the load.
(ii) Speed of rotation of screw rod assuming the threads of double start.
(iii) Max. stress induced on the cross section of the screw rod.
(iv) Efficiency of screw drive.
(v) Length of the nut for the purpose of supporting the load.
(vi) Check for overhaul. Take allowable bending pressure in nut and screw is $\sigma_b' = 15\,MPa$. **(10 Marks)**

* * * * *

CBCS SCHEME

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

18ME53

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Dynamics of Machines

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. State the conditions for static equilibrium of a body subjected to :
(i) Two forces (ii) Three forces **(06 Marks)**

b. A four bar mechanism shown in Fig.Q1(b) has crank 2 driven by an input torque T_2 ; an external load P = 50 N acting at point E on link 3. For the position shown in figure, find the magnitude and direction of torque T_2 for the linkage to be in static equilibrium.

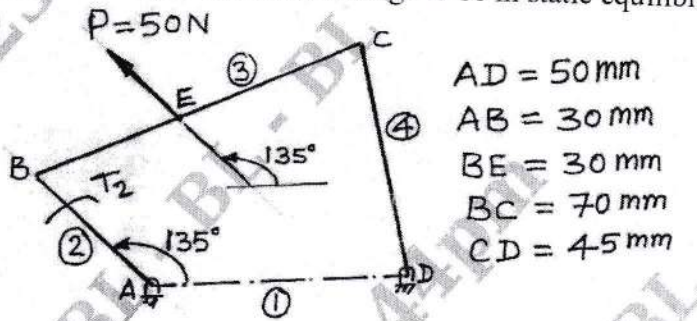


Fig.Q1(b)

(14 Marks)

OR

2 a. State and explain D'Alembert's principle. **(05 Marks)**

b. When the crank is 50° from the inner dead centre on the down stroke, the effective steam pressure on the piston of a vertical steam engine is 2.5 bar. The diameter of the cylinder = 0.80 m, stroke of the piston = 0.5 m and length of the connecting rod = 1 meter. Determine the torque on the crank shaft, if the engine rotates at 350 rpm and the inertia of reciprocating parts 250 kg. **(15 Marks)**

Module-2

3 a. Explain static and dynamic balancing of rotating masses. **(06 Marks)**

b. Four masses A, B, C and D carried on a rotating shaft are at radii 100 mm, 140 mm, 210 mm and 160 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the masses of B, C and D are 16 kg, 10 kg, and 8 kg respectively. Find the required mass A and the relative angular positions of the four masses for the complete balancing of the shaft. **(14 Marks)**

OR

4 In a three cylinder engine, cranks are spaced at an equal angular interval of 120°. Length of connecting rod is 550 mm and the stroke length is 280 mm. The distance between centre line axis of the cylinders is 400 mm. Mass of reciprocating parts of each cylinder is 60 kg and the speed of the engine is 600 rpm. Find the primary and secondary unbalanced forces and couples acting on the reciprocating parts. **(20 Marks)**

Module-3

5 a. Define: (i) Height of governor (ii) Sensitivity of a governor (iii) Effort of a governor **(06 Marks)**

b. The upper arms of a porter governor are pivoted on the axis of rotation, their lengths being 300 mm. The lower arms are 270 mm long and are pivoted on the sleeve at a distance of 30 mm from the axis. Mass of each ball is 6 kg and sleeve mass is 50 kg. Determine the equilibrium speed for a radius of rotation of 170 mm and also the effort and power for one percent change of speed. **(14 Marks)**

OR

6 a. With usual notations, derive an expression for magnitude of Gyroscopic couple. **(08 Marks)**

b. The moment of inertia of an aeroplane air screw is 20 kg-m^2 and its speed of rotation is 1250 rpm clockwise as viewed from the nose. The speed of flight is 200 km/hour. Calculate the gyroscopic couple and discuss the direction and effect of gyroscopic couple on the aeroplane when it takes left turn on a 150 m path radius. **(12 Marks)**

Module-4

7 a. Briefly discuss/explain the following: (i) Simple Harmonic Motion (ii) Degrees of freedom (iii) Logarithmic decrement **(06 Marks)**

b. The mass 'm' is hanging from a chord attached to the circular homogeneous disc of mass 'M' and radius 'R' as shown in Fig.Q7(b). The disc is restrained from rotating by a spring attached at radius 'r' from the centre of the disc. If the mass is displaced downwards from the rest position, determine the frequency of oscillations. Take spring stiffness as 'k'. Use energy method.

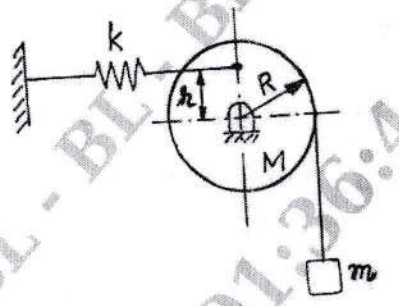


Fig.Q7(b) **(14 Marks)**

OR

8 a. Define: (i) Damping factor (ii) Damping ratio (iii) Critically damped system. **(06 Marks)**

b. In a single degree damped vibrating system, a suspended mass of 8 kg makes 30 oscillations in 18 seconds. The amplitude decreases to 0.25 of the initial value after 5 oscillations. Determine: (i) The stiffness of the spring (ii) Logarithmic decrement (iii) Damping factor (iv) The damping coefficient **(14 Marks)**

Module-5

9 a. Write a brief note on vibration isolation. **(05 Marks)**

b. A machine of total mass 17 kg is mounted on springs having stiffness k = 11000 N/cm. A piston within the machine has a mass of 2 kg which was reciprocating machine with stroke of 75 mm and speed 6000 rpm. Assuming the motion to be Simple Harmonic Motion. Determine: (i) Amplitude of machine (ii) Transmissibility (iii) Force transmitted to the ground or foundation. Take damping factor $\xi = 0.2$. **(15 Marks)**

OR

10 a. Define transmissibility. **(05 Marks)**

b. A shaft of 50 mm diameter and 3m long is supported at the ends and carries three weights of 1000 N, 1500 N and 750 N at 1m, 2m and 2.5 m from the left support, respectively. Take E = 200 GPa and find the frequency of transverse vibration of the shaft. **(15 Marks)**

CBCS SCHEME

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

18ME54

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Turbomachines

Time: 3 hrs. Max. Marks: 100

Note: 1. ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. Thermodynamic data Handbooks are allowed.

Module-1

1 a. Define a turbomachine. List any six differences between a turbo-machine and a positive displacement machine. **(08 Marks)**

b. Indentify the following as power generating or power absorbing turbo-machines. :
i) Kaplan Turbine
ii) Centrifugal blower
iii) De-Laval turbine
iv) Axial compressor **(04 Marks)**

c. A $1/4^{th}$ scale turbine model is tested under a head of 10m. A full scale turbine is required to work under a head of 28.5m and turns at 415rpm. At what speed must the model be run if it develops 94kW and uses $0.96m^3/s$ of water at this speed? What power will be developed from the full scale turbine? Name the type of turbine. **(08 Marks)**

OR

2 a. With h-s diagram, show that reheat factor in a multi-stage turbine is greater than unity. **(08 Marks)**

b. Define :
i) Total to total efficiency
ii) Total to static efficiency for a power
Generating turbomachine with h-s diagram. **(04 Marks)**

c. A 16 stage axial flow compressor is to have a pressure ratio of 6.3 and tests have shown that a stage efficiency of 89.5% can be obtained. The intake conditions are 288K and 1 bar. Find :
i) Overall efficiency
ii) Polytropic efficiency
iii) Pre-heat factor **(08 Marks)**

Module-2

3 a. With usual notations and velocity triangles derive alternate form of Euler turbine equation and identify the components of energy transfer. **(10 Marks)**

b. Define utilization factor for a turbine. Derive an expression relating utilization factor with the degree of reaction. **(10 Marks)**

OR

4 a. A radial outward flow turbomachine has no inlet whirl. The blade speed at exit is twice that at inlet. The radial velocity is constant throughout. Taking the inlet blade angels as 45°, show that the degree of reaction $R = \frac{2+\text{Cot}\beta_2}{4}$, where β_2 = Blade angle at exit with respect to tangential direction. **(12 Marks)**

b. At a stage of an axial flow impulse turbine, the mean blade diameter is 80cm and the sp is 3000rpm. The absolute velocity of the fluid is 300m/s and is inclined at 20° to plane o wheel. If the utilization factor is 0.85 and relative velocity at rotor exit is equal to that at inlet, determine :

i) inlet and exit blade angles
ii) power output in kW for a mass flow rate of 1Kg/s
iii) Sketch the inlet and outlet velocity triangle. **(08 Marks)**

Module-3

5 a. What do you mean by compounding of stream turbine? Explain with the help of a schematic diagram, the following methods of compounding

i) Velocity compounding
ii) Pressure compounding **(10 Marks)**

b. In a de-Laval turbine, steam flow from a nozzle with a velocity of 1200m/s. the nozzle angle is 22°. The mean blade speed is 400m/s and inlet and outlet angle of blades are equal. The mass of steam flowing through the turbine is 0.25Kg/s. Calculate :

i) Blade angle at inlet and outlet
ii) Tangential force on blades
iii) Power developed
iv) Blade efficiency

Take blade coefficient as 0.8. **(10 Marks)**

OR

6 a. Derive an expression for maximum blade efficiency of a single stage impulse turbine in terms of nozzle angles assuming identical blades and relative velocities are same at inlet and exit. **(10 Marks)**

b. The following particulars refer to a Parson's reaction turbine consisting of one ring of fixed blades and one ring of moving blades. The mean diameter of the blade ring is 90cm and its speed is 300rpm. The inlet absolute velocity to the blade is 300m/s. The blade outlet angle is 20°. The stream flow rate is 7.6Kg/s. Calculate :

i) Blade inlet angle
ii) Tangential force
iii) Power developed **(10 Marks)**

Module-4

7 a. Show that for a Pelton wheel, the maximum hydraulic efficiency is given by $(\eta)_{max} = \frac{1 + k\,Cos\beta_2}{2}$. Where K = Blade velocity coefficient β_2 = Blade angle at exit. **(10 Marks)**

b. A three jet Pelton wheel is required to generate 10000kW under a head of 400m. The blade angle at outlet is 15° and reduction in relative velocity over the blade (buckets) is 5%. If overall efficiency is 80%, $C_v = 0.98$ and speed ratio = 0.46.

Find : i) Diameter of jet
ii) Total flow in m^3/s
iii) Force exerted by jet on the buckets **(10 Marks)**

OR

8 a. Explain the functioning of a Kaplan turbine with the help of a sectional arrangement diagram. Draw the velocity triangle of Kaplan turbine. **(10 Marks)**

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

c. Explain the functions of a draft tube in a reaction turbine. **(04 Marks)**

Module-5

9 a. What a primary? Why it is required? Explain how primary is achieved in centrifugal pump. **(04 Marks)**

b. With sketches, explain the principal of multi stage centrifugal pumps in i) series ii) parallel. **(08 Marks)**

c. A centrifugal pump is running at 1000rpm. The outer vane angle of the impeller is 45 and the velocity of flow at the outlet is 2.5m/s. The discharge through the pump is $0.2m^3/s$, when pump is working against a head of 20m. If the manometric efficiency is 80%, draw the outlet velocity diagram and calculate :
   i) Diameter of impeller at outlet
   ii) Width of impeller at outlet **(08 Marks)**

OR

10 a. Explain the phenomenon of surging as applied to a centrifugal compressor. **(06 Marks)**

b. What is slip and slip factor in a centrifugal compressor? Derive an expression for the same. **(06 Marks)**

c. A centrifugal compressor running at 5950rpm having an impeller tip diameter of 100cm has a mass flow rate of air as 30Kg/s. The total pressure ratio is 2.125. The pressure at the inlet is 1 bar and temperature is 0.9 and the mechanical efficiency is 97%. Find :
   i) Total efficiency
   ii) Temperature of air at exit
   iii) Power input needed
   iv) Pressure coefficient **(08 Marks)**

CBCS SCHEME

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

18ME55

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Fluid Power Engineering

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. With a neat sketch, explain structure of hydraulic system. **(10 Marks)**

b. Define Pascal law with an example. **(04 Marks)**

c. Give some applications of hydraulic system. **(06 Marks)**

OR

2 a. Explain the desirable properties of a Hydraulic fluids. **(08 Marks)**

b. Explain the different types of seals used in hydraulic system. **(06 Marks)**

c. For a simple hydraulic jack as shown in Fig.Q.2(c) has the following data Force (F_1) = 100N, Area (A_1) = 50cm^2, Area (A_2) = 500cm^2, Stroke (S_1) = 10cm, find Stroke (S_2). Also find energy input and energy output. **(06 Marks)**

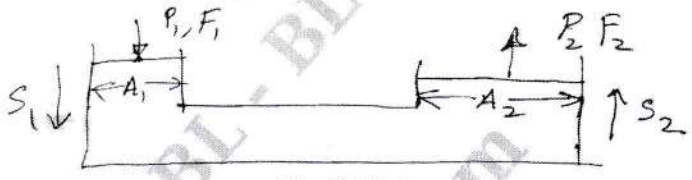


Fig.Q.2(c)

Module-2

3 a. With a neat sketch, explain unbalanced vane pump and derive the expression for volumetric displacement. **(10 Marks)**

b. Find the flow rate in ltr/sec that an axial piston pump delivers at 1000rpm. The pump has 9 no's 15mm diameter pistons arranged on a 125mm diameter piston circle. The offset angle is set at 10° and the volumetric efficiency is 94%. **(10 Marks)**

OR

4 a. Give the classification hydraulic actuators with a neat sketch, explain limited rotation hydraulic actuator. **(10 Marks)**

b. A hydraulic motor has a volumetric displacement of 8×10^{-5}m^3. If it has a pressure rating of 310 bar and it receives oil at 0.038m^3/min theoretically. Find: i) Motor speed ii) Torque iii) Power. **(10 Marks)**

Module-3

5 a. With a neat sketch, explain solenoid actuated 4/3 spool valve. Draw its symbol. **(10 Marks)**

b. With a neat sketch, explain spring loaded relief valve. **(10 Marks)**

OR

6 a. With a neat sketch, explain needle and Globe type flow control valves. **(06 Marks)**

b. With a neat circuit diagram, explain double pump hydraulic system used in punching operation. **(10 Marks)**

c. Draw the symbols for the following:
   i) Variable displacement unidirectional pump
   ii) Limited rotation motor
   iii) Cylinder with cushion
   iv) Gas loaded accumulator. **(04 Marks)**

Module-4

7 a. What are the advantages and limitations of pneumatic power system? (08 Marks)
b. With a neat sketch, explain FRL unit. (08 Marks)
c. Write a neat sketch explain single acting type pneumatic cylinder. (04 Marks)

OR

8 a. What are the different types of control values used in pneumatic system? With a neat sketch, explain quick exhaust valve. (10 Marks)
b. With a neat sketch explain static and dynamic seals used in pneumatic system. (05 Marks)
c. With a symbol explain rodless cylinder. (05 Marks)

Module-5

9 a. With a neat sketch, explain indirect actuation of pneumatic cylinder. (10 Marks)
b. With a circuit diagram, explain OR and AND gates used in pneumatic system. (10 Marks)

OR

10 a. With a circuit diagram, explain signal elimination method. (10 Marks)
b. With a circuit diagram explain pilot operated 3/2 value. (10 Marks)

* * * * *

CBCS SCHEME

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

18ME56

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Operation Management

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define operations management. Explain briefly how the production system are classified. **(10 Marks)**

b. Define productivity. Explain briefly factors affecting productivity. **(10 Marks)**

OR

2 a. Define decision making. Briefly explain the characteristics of operation decisions. **(10 Marks)**

b. Explain break even analysis with necessary equations graphs and assumptions. **(10 Marks)**

Module-2

3 a. Define forecasting. Explain linear regression and exponential smoothing. **(10 Marks)**

b. Use the least squares method to develop a linear trend equation for the data. State the equation complete with signature and forecast a trend value for year 16.

Year	X Year coded	Y Shipments (tons)	XY	X^2
1	-5	2	-10	25
2	-4	3	-12	16
3	-3	6	-18	9
4	-2	10	-20	4
5	-1	8	-8	1
6	0	7	0	0
7	1	12	12	1
8	2	14	28	4
9	3	14	42	9
10	4	18	72	16
11	5	19	95	25
	00			

(10 Marks)

OR

4 a. Briefly explain the components of time series method with sketches. **(10 Marks)**

b. Explain the steps in the forecasting process. Briefly. **(10 Marks)**

Module-3

5 a. Explain briefly : (i) Capacity planning (ii) System capacity (iii) Design capacity (iv) Facility layout. **(10 Marks)**

b. Explain with neat sketch any two types of layout. **(10 Marks)**

OR

6 a. What are the factors influencing plant location? Explain briefly. **(10 Marks)**

b. Explain the various capacity measures. What are the capacity strategies? **(10 Marks)**

Module-4

7 a. Define aggregate planning. Explain the strategies used for aggregate planning in brief. **(10 Marks)**

b. What are the functions of Master Production Schedule? State the difference between AP and MPS. **(10 Marks)**

OR

8 a. What are the objectives of Master Production Scheduling? Explain the Master Production Schedule with a neat diagram. **(10 Marks)**

b. What are the focused aggregate planning strategies? Explain briefly. **(10 Marks)**

Module-5

9 a. Define MRP. What are the various steps involved in the implementation of MRP? **(10 Marks)**

b. Explain the key features of MRP system. List the benefits and limitation of MRP. **(10 Marks)**

OR

10 a. Explain Bull Whip effect. What are the root causes for bull whip effect? **(10 Marks)**

b. Define supply chain. Explain supply chain management with a schematic model. **(10 Marks)**

* * * * *

18 VI Sem ME

CBCS SCHEME

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

18ME62

Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Design of Machine Elements – II

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Derive an expression for shear stress induced in helical compression spring. **(08 Marks)**

b. A truck spring has a overall length of 1.2m and sustain a load of 60kN. The spring has 3 full length and 15 graduated leaves. All the leaves are stressed to 360MPa when fully loaded. The ratio of total depth to width is 2. Take E = 206GPa. Determine the width and thickness of leaves, the camber and load exerted on band. **(12 Marks)**

OR

2 a. Define slip and creep in belt. Explain the effect of slip on velocity ratio. **(10 Marks)**

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

Module-2

3 a. Derive Lewis equation of spur gear teeth. **(05 Marks)**

b. It is required to transmit 25kW power from a shaft running at 1000rpm to a parallel shaft with speed reduction 2.5:1. The centre distance of shafts is to be 300mm. The material used for pinion is steel $(\sigma_{d_1} = 200\text{MPa}, \text{BHN} = 250)$ and the gear is CI $(\sigma_{d_2} = 140\text{MPa}, \text{BHN} = 200)$. Considering class-II gear with tooth profile is 20° FDI. Design the spur gear and check the design for dynamic and wear load. **(15 Marks)**

OR

4 A pair of steel helical gear is to transmit 15kW at 5000rpm of the pinion, both pinion and gears are made of the same material, hardened steel with allowable bending stress of 120MPa. The gears are to be operated at a centre distance of 200mm, speed reduction is 4:1. The teeth are 20° FDI. On transverse plane, helix angle is 45°. The gears are manufactured to class-III accuracy (precision class). Face width can be taken as 16 times the normal module. Design the helical gears and suggest suitable hardness. **(20 Marks)**

Module-3

5 a. Derive an equation for "formative number of teeth" on bevel gear. **(08 Marks)**

b. A pair of bevel gears transmitting 7.5kW at 300rpm of pinion. The pressure angle is 20°. The pitch diameters of pinion and gear at their large ends are 150mm and 200mm respectively. The face width of the gears is 40mm. Determine the components of the resultant gear tooth force and draw a free body diagram of forces acting on the pinion and the gear. **(12 Marks)**

OR

6 Complete the design and determine the input capacity of a 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 to be 200mm and transmission ratio is 10 and worm speed is 2000rpm. **(20 Marks)**

Module-4

7 a. Derive an equation for torque transmitted by disc clutch. **(10 Marks)**

b. A cone clutch with asbestos friction lining transmits 30kW at 500rpm. The coefficient of friction is 0.2 and the permissible intensity of pressure is 0.35N/mm^2. The semi-cone angle is 12.5°. The outer diameter is fixed as 300mm from space limitations. Assuming uniform wear theory calculate:

i) The inner diameter
ii) The face width of friction lining and
iii) The force required to engage the clutch. **(10 Marks)**

OR

8 a. A single block brake shown in Fig.Q.8(a) is to balance a torque of 500Nm on a drum shaft at 1000rpm. Assuming coefficient of friction to be 0.25 and $2\theta < 60°$ determine:

i) Tangential force on the shoe
ii) Normal force
iii) Force 'F' required to apply brake
iv) The dimension 'C' required to make the brake self locking assuming other dimensions remain the same.
v) Heat generated. **(10 Marks)**

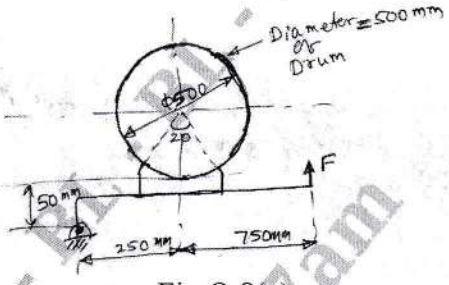


Fig.Q.8(a)

b. A differential band brake is shown in Fig.Q.8(b). The width and the thickness of the steel band are 100mm and 3mm respectively and the permissible tensile stress in the band is limited to 50N/mm^2. The coefficient of friction between the friction lining and the brake drum is 0.25, calculate: i) Tensions in the band ii) The actuating force iii) The torque iv) Find out whether the brake is self locking? **(10 Marks)**

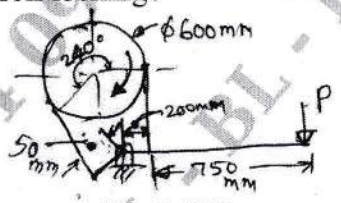


Fig.Q.8(b)

Module-5

9 a. Derive Petroff's equation, also list the assumptions made. **(08 Marks)**

b. A 200mm diameter bearing is 100mm long and has a load of 30kN. It runs at 900rpm. Clearance is 0.1mm. Oil used as SAE40. Operating temperature = 70°C. Find the power loss due to friction. **(12 Marks)**

OR

10 Select suitable single row radial ball bearings to carry a radial load of 1.5kN and a thrust load of 1.2kN at 900rpm. The bearing is to be used 7 hours per day and average service life of 8 years is desired. Consider the design load for bearing during selection with speed factor, life factor, thrust factor and application factor. **(20 Marks)**

* * * * *

CBCS SCHEME

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

18ME63

Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Heat Transfer

Time: 3 hrs. Max. Marks: 100

Note:* 1. *Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of heat transfer, thermodynamic data handbook and steam tables are permitted.

Module-1

1 a. Write down three-dimensional heat conduction for Cartesian coordinates. Explain all the terms involved. Also reduce this equation as the Poisson's, Laplace, Fourier equation and one dimensional equation. **(08 Marks)**

b. A plane wall of thickness L is subjected to a heat supply at a rate of q_0 W/m^2 at one boundary surface and dissipates heat from the surface by convection to the ambient which is at a uniform temperature of T_∞ with a surface heat transfer coefficient of h_∞. Write the mathematical formulation of the boundary conditions for plane wall. **(08 Marks)**

c. What is meant by thermal diffusivity? What is its significance? **(04 Marks)**

OR

2 a. Derive the general three dimensional conduction equation in Cartesian coordinates and state the assumptions made. **(08 Marks)**

b. A wall of a furnace is made up of inside layer of silica brick 120 mm thick covered with a layer of magnesite brick 240 mm thick. The temperatures at the inside surface of silica brick wall and outside surface of magnesite brick wall are 725°C and 110°C respectively. The contact thermal resistance between the two walls at the interface is 0.0035°C/W per unit wall area. If thermal conductivities of silica and magnesite bricks are 1.7 W/m°C and 5.8 W/m°C. Calculate:
(i) The rate of heat loss unit area of wall
(ii) The temperature drop at the interface **(08 Marks)**

c. What is meant by critical insulation? What is its significance on steam pipe and electrical cables? **(04 Marks)**

Module-2

3 a. Derive the differential equation governing the temperature distribution for a fin of a uniform cross section by assuming thermal conductivity, the heat transfer coefficient and ambient temperature being constant. **(08 Marks)**

b. A rod [K = 200 W/mK] 5 mm in diameter and 5 cm long has its one end maintained at 100°C. The surface of the rod is exposed to ambient air at 25°C with convection heat transfer coefficient of 100 W/m^{2}K. Assuming other end is insulated. Determine:
(i) The temperature of rod at 20 mm distance from the end at 100°C.
(ii) Heat dissipation rate from the surface. **(08 Marks)**

c. Differentiate between effectiveness and efficiency of fin. **(04 Marks)**

OR

4 a. Obtain an expression for instantaneous heat transfer for lumped heat transfer analysis of heat conduction problem. **(08 Marks)**

b. A 12 cm diameter long bar initially at a uniform temperature of 40°C is placed in a medium at 650°C with a convective coefficient of 22 W/m^2K. Calculate the time required for the bar to reach 255°C. Take K = 20 W/mK, $\rho = 580\ kg/m^3$, c = 1050 J/kgK. **(08 Marks)**

c. What are Heisler charts? Explain their significance. **(04 Marks)**

Module-3

5 a. Explain formulation of differential equation 1-D steady heat conduction. **(08 Marks)**

b. Explain different solution method used in numerical analysis of heat conduction. **(08 Marks)**

c. Explain application and computations error of numerical analysis heat conduction. **(04 Marks)**

OR

6 a. State and explain:
(i) Stefan Boltzman law (ii) Krichoff's law
(iii) Wien's displacement law (iv) Lambert's cosine law **(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, $\epsilon_{hotplate} = 0.9$, $\epsilon_{coldplate} = 0.6$. If a polished aluminium shield is placed between them. Find the percentage reduction in heat transfer, $\epsilon_{shield} = 0.04$. **(08 Marks)**

c. Write concept of Black Body. **(04 Marks)**

Module-4

7 a. Explain physical significance of:
(i) Grashoff number (ii) Prandtl Number
(iii) Nusselt number (iv) Reynolds number **(08 Marks)**

b. A tube of 0.036 m OD, 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 HT from the surface of the tube (i) If tube is vertical (ii) if tube is horizontal **(08 Marks)**

c. A vertical door of a hot oven is 0.5 m high and is maintained at 200°C. It is exposed to atm air at 20°C find local heat transfer coefficient half way up to the door. Take properties of air at 110°C, $\nu = 24.29 \times 10^{-6}\ m^2/s$, Pr = 0.687, K = 0.03274 W/mL. **(04 Marks)**

OR

8 a. Using dimensional analysis, obtain the dimensionless parameters in forced convection heat transfer. **(08 Marks)**

b. Air at 20°C and 1 atm flows over a flat plate at 35 m/s. The plate is 75 cm long and is maintained at 60°C. Assuming unit depth in the z-direction. Calculate heat transfer from the plate. **(08 Marks)**

c. What is difference between:
(i) free and forced convection
(ii) Laminar and turbulent flow **(04 Marks)**

Module-5

9 a. Derive an expression for LMTD of counter flow heat exchanger. State the assumptions made. **(08 Marks)**

b. The flow rate of hot and cold flux streams running through a parallel flow heat exchanger are 0.2 kg/s and 0.5 kg/sec respectively. The inlet temperature on the hot and cold sides are 75°C and 20°C respectively. The exit temperature of hot water is 45°C. If the individual heat transfer coefficient on both sides are 650 $W/m^2{}^\circ C$. Calculate area of heat transfer. **(08 Marks)**

c. Write a note on Fouling Factor **(04 Marks)**

OR

10 a. Water is boiled at a rate of 30 kg/hour in a copper pan 30 cm dia at atmospheric pressure. Estimate temperature at bottom of the surface of the pan. Assuming nucleate boiling condition. **(08 Marks)**

b. A vertical cooling fin approximate a flat plate of 40 cm height and is exposed to saturated steam at 100°C. (h_{fg} = 2257 kJ/kg). The fin is maintained at a temperature of 90°C. Calculate:

(i) Thickness of film at bottom of film

(ii) Average heat transfer coefficient

(iii) Heat transfer after incorporating Mc-Adam's correction factor.

Take $\rho = 965.8$ kg/m^3, K = 0.68 W/mK, $\mu = 3.153 \times 10^{-4}$ kg/m-s **(08 Marks)**

c. Differentiate:

(i) Sub cooled boiling and saturated boiling

(ii) Drop wise condensation and film wise condensation. **(04 Marks)**

* * * * *

CBCS SCHEME

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

18ME651

Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Non – Conventional Energy Sources

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Discuss the different Renewable Energy sources with special reference to Indian Context. **(10 Marks)**

b. Enlist the merits and demerits of any two Non – Conventional Energy sources. **(10 Marks)**

OR

2 a. With schematic representation, explain the Mechanism of Absorption , Scattering , Beam and diffuse radiation received at Earth's surface. **(10 Marks)**

b. Name the instruments used for Solar radiation measurement. Explain with sketch the working principle of Phyranometer and Sunshine recorder. **(10 Marks)**

Module-2

3 a. Discuss the following terms with sketch : i) Surface Azimuth angle ii) Solar Azimuth angle iii) Solar Altitude angle. **(10 Marks)**

b. Write an expression for tilt factor of beam radiation when tilted surface facing South. **(04 Marks)**

c. At Nagapur the following observations were made : Theoretical maximum possible sunshine hours = 9.5h ; Average measured length of day during April = 9.0h ; Solar radiation for a clear day ; H_o = 2100 kJ/m^2/day. Constants : a = 0.27 , b = 0.5. Calculate the average daily global radiation. **(06 Marks)**

OR

4 a. Write the advantages and disadvantages of concentrating collectors over the flat plate type solar collectors. **(09 Marks)**

b. Describe the principle of working of Solar chimney power plant. **(06 Marks)**

c. Name the different types of Solar thermal collectors and explain the working of liquid flat plate Solar collector with sketch. **(10 Marks)**

Module-3

5 a. Discuss the top loss and bottom loss coefficients in a flat plate collectors with necessary equations. **(10 Marks)**

b. Use the following data to calculate the overall loss coefficient of a flat plate collector : Size of the absorber plate = 2.15m × 1.15m ; Spacing between absorber plate and 1st glass cover = 5cm ; Spacing between 1st and 2nd glass cover = 5cm ; Glass cover Emissivity = 0.85 ; Plate Emissivity = 0.90 ; Mean plate temperature = 25°C ; Ambient air temperature = 20°C Collector tilt = 30°C ; Wind speed = 3m/s ; Back insulation thickness = 8cm ; Side insulation thickness = 4cm ; Thermal conductivity of insulation = 0.035W/m-K ; Stefan – Boltzmann constant = 5.67 × 10^{-8} W/m^2 – K^4. Determine the overall loss coefficient. **(10 Marks)**

OR

6 a. Mention the four important applications of Solar photovoltaic system. (04 Marks)
b. Explain the Quantum Dot Solar Cell Technology. (06 Marks)
c. Write the classification of solar cells. Discuss the factors to be considered in solar cell design. (10 Marks)

Module-4

7 a. What are the most favorable sites for installing of wind turbine? (04 Marks)
b. Sketch and explain the diagram of HAWT. (06 Marks)
c. An Aero – generator generates an output of 1200 W at wind speed of 5m/s at one atmospheric pressure and a temperature of 20°C. What will be the output, if the same aero generator is installed on the top of the hill where temperature is 10°C , Pressure is 0.85 atmospheric and wind speed is 6m/s. (10 Marks)

OR

8 a. What are the problems associated with Tidal Energy? Explain the working of double basin Tidal Power plant. (10 Marks)
b. With the neat sketch, explain the working principle of OTEC (closed) plant. State the problems associated with OTEC. (10 Marks)

Module-5

9 a. State the Environmental problems associated with Geothermal Energy Conversion. (04 Marks)
b. Explain the factors affecting the Bio – gas generation. (06 Marks)
c. Sketch and explain KVIC bio gas plant. (10 Marks)

OR

10 a. What are the different methods for Hydrogen production? Explain Electrolysis process with sketch. (10 Marks)
b. Explain the following :
i) Photo synthesis ii) Energy plantation. (10 Marks)

* * * * *

CBCS SCHEME

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

18ME653

Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Supply Chain Management

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. What is a Supply Chain? Define its objectives and importance. **(10 Marks)**

b. Describe the two process views of a Supply Chain in detail. **(10 Marks)**

OR

2 a. What is a Strategic Fit? How do you achieve it? Explain. **(12 Marks)**

b. List the Drivers and Enablers of Supply Chain and discuss the role of them in Supply Chain performance. **(08 Marks)**

Module-2

3 a. How do Firms take make Vs Buy decisions? Explain with an example of a Telecommunication Company. **(12 Marks)**

b. Explain the terms Economics of Scale , Agency Costs and Transaction Costs. **(08 Marks)**

OR

4 a. What is the impact of Internet on Sourcing Strategy? Discuss. **(12 Marks)**

b. Mr. Mahesh and Suresh wanted to open a Bakery. The major decision should be taken by them is whether to make Cakes on site (or) buy Cakes from others. If they buy from other's they require some air tight containers which costs Rs 2000/- annually. The buying cost per Cake is Rs 0.8/-. If they make the Cakes in house, they need Kitchen costing Rs 30,000 per year and Rs 0.3/- per Cake to make. They trust themselves that they will sell 1,20,000 Cakes. So Mahesh and Suresh wants to know if they should make (or) buy the Cakes. **(08 Marks)**

Module-3

5 a. Differentiate Centralized and Decentralized Stores in detail. **(08 Marks)**

b. Briefly explain what is Stores Management, its objectives and functions. **(12 Marks)**

OR

6 a. What are the various factors influencing the network design decisions? Discuss. **(10 Marks)**

b. Enlist the design options for a distribution network and explain Manufacturing storage with direct shipping. **(10 Marks)**

Module-4

7 a. What is the role of forecasting in a Supply Chain? Explain. **(05 Marks)**

b. Discuss about the Time series method of forecasting. **(07 Marks)**

c. Write a short note on Safety Stock. **(08 Marks)**

OR

8 a. Explain the Decision Tree Methodology in detail. **(10 Marks)**

b. State the impact of Uncertainity on Network design and brief about Discounted Cash Flow (DCF). **(10 Marks)**

Module-5

9 a. What are the effects due to lack of co-ordination in Supply Chain? Explain. Also list the various obstacles for coordination. **(12 Marks)**

b. What is the future of IT in Supply Chain? Discuss. **(08 Marks)**

OR

10 a. "Supply Chain Restructuring", explain the process. **(08 Marks)**

b. List the various problems in implementing the Postponement strategy. **(04 Marks)**

c. "Building Partnership and Trust" in a Supply Chain. Discuss. **(08 Marks)**

* * * * *

CBCS SCHEME

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

18ME641

Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Non-traditional Machining

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain the need of NTM and give the complete classification of NTM. **(10 Marks)**
b. Difference between traditional and non-traditional machining process. **(10 Marks)**

OR

2 a. Explain NTM process selection. **(10 Marks)**
b. Explain different feed mechanisms used in Ultrasonic Machining (USM). **(10 Marks)**

Module-2

3 a. Explain the parameters that effect on metal removal in USM process. **(10 Marks)**
b. With a neat sketch explain equipment and operation of Ultrasonic machining. **(10 Marks)**

OR

4 a. With neat sketch explain equipment and operation at Abrasive Jet Machining (AJM). **(12 Marks)**
b. Explain process characteristics of AJM. **(08 Marks)**

Module-3

5 a. Explain the chemistry of ECM process with diagram. **(08 Marks)**
b. With a neat sketch explain chemical blanking process and list out CHM applications. **(12 Marks)**

OR

6 a. Explain process parameters of ECM. **(10 Marks)**
b. With a neat sketch, explain chemical milling process. **(10 Marks)**

Module-4

7 a. Explain with sketch, the mechanism of metal removal in electrical discharge machining. **(10 Marks)**
b. Which are the important considerations are to be made in the design of plasma torch? **(10 Marks)**

OR

8 a. With a neat sketch, explain the working of PAM. List out the advantage and limitations of process. **(14 Marks)**
b. With a neat sketch, explain Electrical Discharge Grinding (EDG). **(06 Marks)**

Module-5

9 a. With a neat sketch, explain equipment of Laser Beam Machining (LBM). **(10 Marks)**
b. Explain process parameters of EBM and its applications. **(10 Marks)**

OR

10 a. With a neat sketch, explain electron beam machining and list out its advantages and disadvantages. **(12 Marks)**
b. With a neat sketch, explain Nd – YAG (neodymium Yttrium – aluminum garnet) layer used in LBM. **(08 Marks)**

CBCS SCHEME

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

18ME654

Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Advanced Material Technology

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Discuss motivation and cost basis for material selection. **(10 Marks)**
b. Explain various properties required in engineering materials. **(10 Marks)**

OR

2 a. Write a note on material selection. **(10 Marks)**
b. Explain the concept of corrosion and wear resistance for material selection. **(10 Marks)**

Module-2

3 a. Explain the following in short:
i) Fiber reinforced composites
ii) Laminated composites
iii) Dispersed Material Composites. **(10 Marks)**
b. Draw the various reinforcement and geometrics for Aluminium Matrix Composite (AMC). Write on Aluminium Matrix Composites. **(10 Marks)**

OR

4 a. Explain the following in short :
i) Titanium Matrix Composites
ii) Copper Matrix Composites **(10 Marks)**
b. Write a note on Polyester resin and Epoxy resin. **(10 Marks)**

Module-3

5 a. Explain various types of Bioceramics. **(10 Marks)**
b. Write a note on Calcium Phosphate ceramics and write its applications. **(10 Marks)**

OR

6 a. Define the Super alloys. Explain various phases and applications of Super alloys. **(10 Marks)**
b. Explain the mechanical properties of low temperature materials. **(10 Marks)**

Module-4

7 a. Write a note on intermetallic, nickel and titanium aluminides. **(10 Marks)**
b. Explain the following in short :
i) Duel steel ii) High strength low alloys iii) Maraging steel. **(10 Marks)**

OR

8 a. Explain the following in short :
i) Coatings ii) Adhesive **(10 Marks)**
b. Discuss formation of polymeric structure. **(10 Marks)**

Module-5

9 a. Briefly explain various applications of Shape Memory alloys. **(10 Marks)**

b. Define Smart Materials. Discuss classification and types of smart materials. **(10 Marks)**

OR

10 a. Define nanomaterials. Explain in short carbon nano tubes and nano composites. **(10 Marks)**

b. Discuss mechanical properties of nano materials. Write applications of nanomaterials. **(10 Marks)**

* * * * *

CBCS SCHEME

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

18ME54

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Turbomachines

Time: 3 hrs. Max. Marks: 100

Note: 1. ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. Thermodynamic data Handbooks are allowed.

Module-1

1 a. Define a turbomachine. List any six differences between a turbo-machine and a positive displacement machine. **(08 Marks)**

b. Indentify the following as power generating or power absorbing turbo-machines. :
i) Kaplan Turbine
ii) Centrifugal blower
iii) De-Laval turbine
iv) Axial compressor **(04 Marks)**

c. A $1/4^{th}$ scale turbine model is tested under a head of 10m. A full scale turbine is required to work under a head of 28.5m and turns at 415rpm. At what speed must the model be run if it develops 94kW and uses $0.96m^3/s$ of water at this speed? What power will be developed from the full scale turbine? Name the type of turbine. **(08 Marks)**

OR

2 a. With h-s diagram, show that reheat factor in a multi-stage turbine is greater than unity. **(08 Marks)**

b. Define :
i) Total to total efficiency
ii) Total to static efficiency for a power
Generating turbomachine with h-s diagram. **(04 Marks)**

c. A 16 stage axial flow compressor is to have a pressure ratio of 6.3 and tests have shown that a stage efficiency of 89.5% can be obtained. The intake conditions are 288K and 1 bar. Find :
i) Overall efficiency
ii) Polytropic efficiency
iii) Pre-heat factor **(08 Marks)**

Module-2

3 a. With usual notations and velocity triangles derive alternate form of Euler turbine equation and identify the components of energy transfer. **(10 Marks)**

b. Define utilization factor for a turbine. Derive an expression relating utilization factor with the degree of reaction. **(10 Marks)**

OR

4 a. A radial outward flow turbomachine has no inlet whirl. The blade speed at exit is twice that at inlet. The radial velocity is constant throughout. Taking the inlet blade angels as 45°, show that the degree of reaction $R = \frac{2 + \text{Cot}\beta_2}{4}$, where β_2 = Blade angle at exit with respect to tangential direction. **(12 Marks)**

b. At a stage of an axial flow impulse turbine, the mean blade diameter is 80cm and the speed is 3000rpm. The absolute velocity of the fluid is 300m/s and is inclined at 20° to plane of wheel. If the utilization factor is 0.85 and relative velocity at rotor exit is equal to that at inlet, determine :

i) inlet and exit blade angles
ii) power output in kW for a mass flow rate of 1Kg/s
iii) Sketch the inlet and outlet velocity triangle.

(08 Marks)

Module-3

5 a. What do you mean by compounding of stream turbine? Explain with the help of a schematic diagram, the following methods of compounding

i) Velocity compounding
ii) Pressure compounding

(10 Marks)

b. In a de-Laval turbine, steam flow from a nozzle with a velocity of 1200m/s. the nozzle angle is 22°. The mean blade speed is 400m/s and inlet and outlet angle of blades are equal. The mass of steam flowing through the turbine is 0.25Kg/s. Calculate :

i) Blade angle at inlet and outlet
ii) Tangential force on blades
iii) Power developed
iv) Blade efficiency

Take blade coefficient as 0.8.

(10 Marks)

OR

6 a. Derive an expression for maximum blade efficiency of a single stage impulse turbine in terms of nozzle angles assuming identical blades and relative velocities are same at inlet and exit.

(10 Marks)

b. The following particulars refer to a Parson's reaction turbine consisting of one ring of fixed blades and one ring of moving blades. The mean diameter of the blade ring is 90cm and its speed is 300rpm. The inlet absolute velocity to the blade is 300m/s. The blade outlet angle is 20°. The stream flow rate is 7.6Kg/s. Calculate :

i) Blade inlet angle
ii) Tangential force
iii) Power developed

(10 Marks)

Module-4

7 a. Show that for a Pelton wheel, the maximum hydraulic efficiency is given by $(\eta)_{max} = \frac{1 + k\,Cos\beta_2}{2}$. Where K = Blade velocity coefficient β_2 = Blade angle at exit.

(10 Marks)

b. A three jet Pelton wheel is required to generate 10000kW under a head of 400m. The blade angle at outlet is 15° and reduction in relative velocity over the blade (buckets) is 5%. If overall efficiency is 80%, $C_v = 0.98$ and speed ratio = 0.46.

Find : i) Diameter of jet
ii) Total flow in m^3/s
iii) Force exerted by jet on the buckets

(10 Marks)

OR

8 a. Explain the functioning of a Kaplan turbine with the help of a sectional arrangement diagram. Draw the velocity triangle of Kaplan turbine. **(10 Marks)**

b. Define the following efficiencies of a hydraulic turbine :

i) Hydraulic efficiency
ii) Mechanical efficiency
iii) Overall efficiency **(06 Marks)**

c. Explain the functions of a draft tube in a reaction turbine. **(04 Marks)**

Module-5

9 a. What a primary? Why it is required? Explain how primary is achieved in centrifugal pump. **(04 Marks)**

b. With sketches, explain the principal of multi stage centrifugal pumps in i) series ii) parallel. **(08 Marks)**

c. A centrifugal pump is running at 1000rpm. The outer vane angle of the impeller is 45 and the velocity of flow at the outlet is 2.5m/s. The discharge through the pump is $0.2m^3/s$, when pump is working against a head of 20m. If the manometric efficiency is 80%, draw the outlet velocity diagram and calculate :

i) Diameter of impeller at outlet
ii) Width of impeller at outlet **(08 Marks)**

OR

10 a. Explain the phenomenon of surging as applied to a centrifugal compressor. **(06 Marks)**

b. What is slip and slip factor in a centrifugal compressor? Derive an expression for the same. **(06 Marks)**

c. A centrifugal compressor running at 5950rpm having an impeller tip diameter of 100cm has a mass flow rate of air as 30Kg/s. The total pressure ratio is 2.125. The pressure at the inlet is 1 bar and temperature is 0.9 and the mechanical efficiency is 97%. Find :

i) Total efficiency
ii) Temperature of air at exit
iii) Power input needed
iv) Pressure coefficient **(08 Marks)**

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

18ME61

Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Finite Element Methods

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define Finite Element Methods. Explain general steps in Finite Element Methods. **(10 Marks)**

b. Fig.Q.1(b) shows a bar fixed at both ends subjected to an axial load as shown. Determine displacement at loading point and corresponding stress using R-R method. **(10 Marks)**

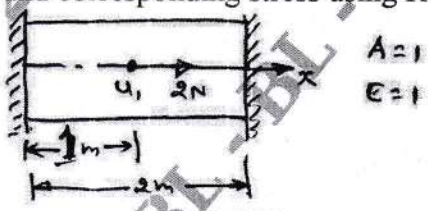


Fig.Q.1(b)

OR

2 a. Explain convergence criteria and different types of elements in Finite Element Methods. **(10 Marks)**

b. A cantilever beam subjected to U.D.L. Derive an equation for maximum deflection using Galerkin's method use polynomial function. **(10 Marks)**

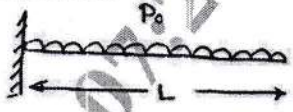


Fig.Q.2(b)

Module-2

3 a. Derive shape functions for TET-4 element. **(10 Marks)**

b. A stepped bar shown in Fig.Q.3(b). Determine the nodal displacement and stresses at each node. Take $E = 2 \times 10^5 N/mm^2$.

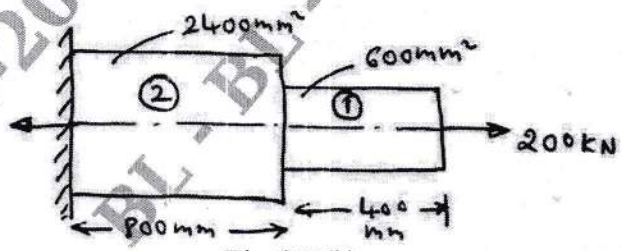


Fig.Q.3(b)

(10 Marks)

OR

4 a. Derive shape functions for C.S.T element in natural coordinates. **(10 Marks)**

b. Using Gaussian quadrature evaluate,

$$I = \int_{-1}^{+1} \left[3e^3 + 3^2 + \frac{1}{3+2} \right] d_3$$ by one point and two point formula. **(10 Marks)**

Module-3

5 a. Derive Hermite shape functions for beam element. **(10 Marks)**

b. A cantilever beam subjected to point load of 250kN as shown in Fig.Q.5(b). Determine deflection at free end and support reactions. E = 200GPa, I = 4 × 10^6mm^4. **(10 Marks)**

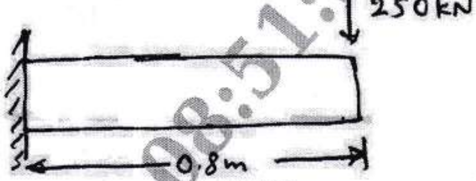


Fig.Q.5(b)

OR

6 a. Derive stiffness matrix for torsion of shaft. **(10 Marks)**

b. A solid stepped bar of circular cross section as shown in Fig.Q.6(b). Subjected to torque of 1kN-m at free end and torque 3kN-m at change in C/S. Determine angle of twist and shear stresses in bar E = 2 × 10^5N/mm^2 G = 7 × 10^4N/mm^2. **(10 Marks)**

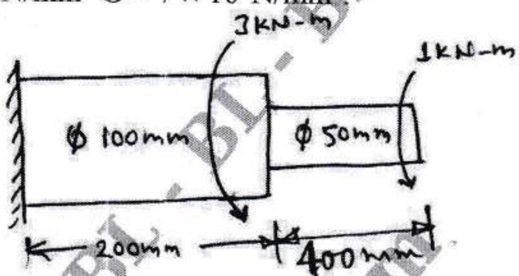


Fig.Q.6(b)

Module-4

7 a. Derive differential equation for 1D heat conduction. **(10 Marks)**

b. Determine the temperature distribution in a rectangular fin shown in Fig.Q.7(b). Assume steady and only conduction process. Heat generated inside the fin as 400W/m^3. **(10 Marks)**

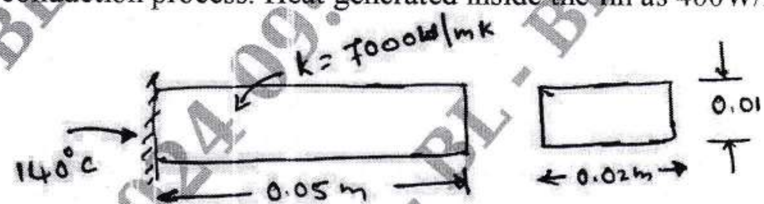


Fig.Q.7(b)

OR

8 For the smooth pipe of variable C/S shown in Fig.Q.8. Determine the potential at junctions, the velocities in each section pipe and volumetric flow rate. The potential at left end P_1 = 10m^2/sec and that at right end P_4 = 1m^2/sec for the fluid flow through smooth pipe K_x = 1. **(20 Marks)**

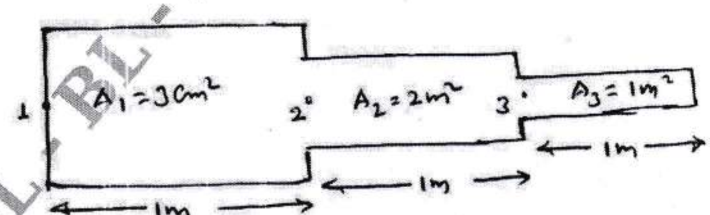


Fig.Q.8

Module-5

9 a. For the element of axisymmetric body rotating with constant angular velocity W = 1000 lev/min shown in Fig.Q.9(a). Determine the body force vector include weight of material, where specific density is 7850kg/m^3. **(10 Marks)**

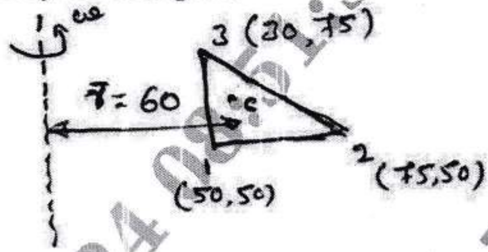


Fig.Q.9(a)

b. Evaluate nodal forces used to replace the linearly varying surface traction shown in Fig.Q.9(b). **(10 Marks)**

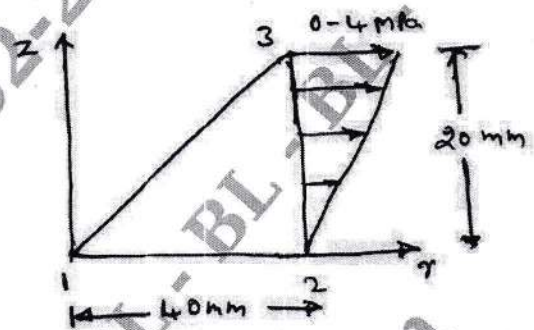


Fig.Q.9(b)

OR

10 a. Derive an equation for consistent mass matrix of 1D bar element. **(10 Marks)**

b. Derive an equation for truss element in consistent mass matrix. **(10 Marks)**

* * * * *

0 / 18-VII Sem. ME

CBCS SCHEME

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

18ME71

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024
Control Engineering

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define control system. With example, explain open loop control system and closed loop control system. **(10 Marks)**

b. List the types of controllers and explain PID controller with block diagram. **(10 Marks)**

OR

2 a. A thermometer is dipped in a vessel containing a liquid at constant temperature "$\theta_i(t)$" with thermal capacitance "C" and Thermal Resistance (R). Temperature indicated by thermometer is "$\theta_0(t)$". Develop a transfer function for the system. **(10 Marks)**

b. Develop a transfer function $\frac{X_2(s)}{F(s)}$ for the Fig.Q2(b).

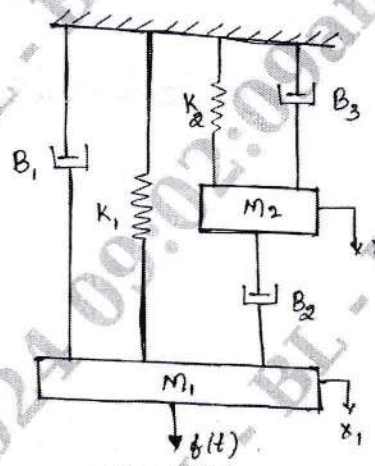


Fig.Q2(b) **(10 Marks)**

Module-2

3 a. List and explain the various standard inputs used in control system analysis. **(10 Marks)**

b. Develop an expression for steady state error for a simple closed loop control system. **(10 Marks)**

OR

4 a. Examine a 2nd order under damped system subjected to unit step input. **(10 Marks)**

b. Evaluate the following quantities for a 2nd order unity feedback system with open loop transfer function $G(s) = \frac{25}{s(s+7)}$, find :

(i) Undamped natural frequency
(ii) Damping ratio
(iii) Damped natural frequency
(iv) Setting time
(v) Raise time
(v) Peak time
(vi) The percentage over shoot for unit step input. **(10 Marks)**

Module-3

5 a. List the basic elements of block diagram. **(05 Marks)**

b. Develop a closed loop transfer function for the block diagram shown in Fig.Q5(b).

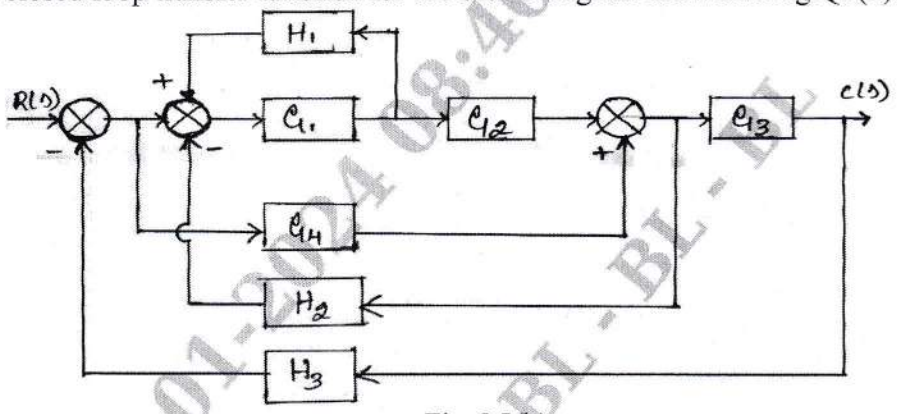


Fig.Q5(b) **(15 Marks)**

OR

6 a. Explain the terms (i) Node (ii) Input node (iii) Output node (iv) Branch (v) Path. **(05 Marks)**

b. Construct a S.F.G. for a block diagram shown in Fig.Q6(b) and obtain a transfer function using Mason's gain formula.

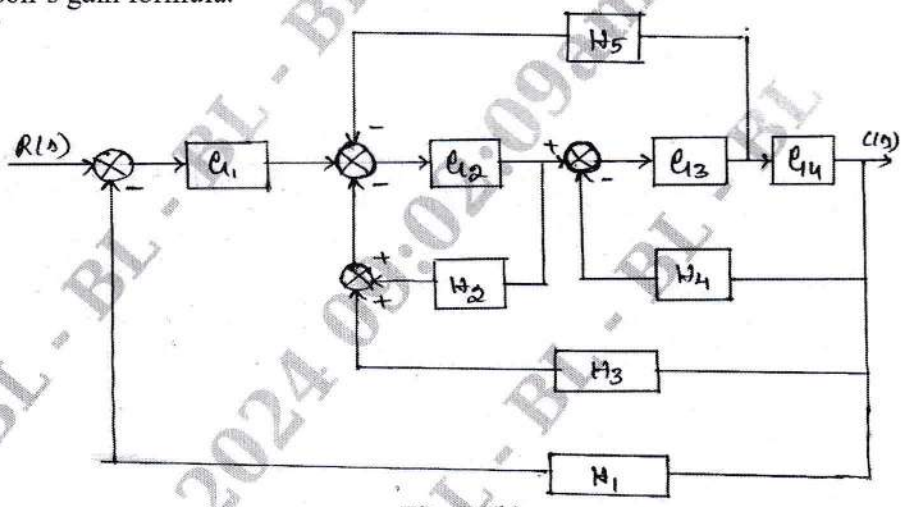


Fig.Q6(b) **(15 Marks)**

Module-4

7 a. For a system with characteristic equation $F(s) = s^6 + 3s^5 + 4s^4 + 6s^3 + 5s^2 + 3s + 2 = 0$. Examine stability using Routh Herwitz criterion. **(10 Marks)**

b. A given system oscillates with frequency 2 rad/sec. Find values of K_{mar} and 'P' are in RHS.

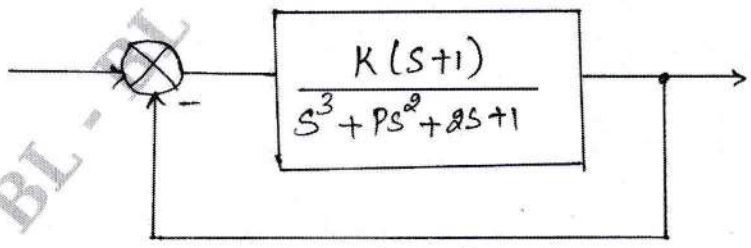


Fig.Q7(b) **(10 Marks)**

OR

8 Construct a root locus for all value of 'K' ranging from 0 to ∞ for a feedback control system characterized by

$$G(s)H(s) = \frac{K}{s(s+4)(s^2+4s+20)}$$ **(20 Marks)**

Module-5

9 Using Nyquist crieterion, examine the stability of a system whose open loop transfer function is

$$G(s)H(s) = \frac{K}{(s+1)(s+2)(s+3)}$$ **(20 Marks)**

OR

10 Construct a Bode plot for the following transfer function and determine gain margin and phase margin:

$$G(s)H(s) = \frac{10}{s(1+s)(1+0.02s)}$$ **(20 Marks)**

* * * * *

CBCS SCHEME

18ME72

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

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024
Computer Aided Design and Manufacturing

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define CAD and CAM. Briefly explain the features of Fixed automation and programmable automation. **(06 Marks)**

b. Illustrate the following with mathematical models:
(i) Production capacity
(ii) Work in process
(iii) TIP ratio **(06 Marks)**

c. A batch manufacturing plant must be processed through 7 machines. There are 30 new batches. Average operation time is 8 min. Average setup time is 2 hours and non-operations time is 4 hours. Average batch size is 15 parts. Number of workstations is 10. The plant operates for an average of 125 hours/week. Determine manufacturing lead time, plant capacity and utilization. **(08 Marks)**

OR

2 a. What are automated flow lines? With sketches, explain Inline and Rotary type of automated flow lines. **(08 Marks)**

b. Describe the methods of control of an automated flow line. **(06 Marks)**

c. The following data applies to a 12 station inline transfer line, p = 0.01 for all the stations, cycle time is 0.3 min and repair time is 3 min using upper bound approach, compute the following:
(i) Frequency of line stops/cycle
(ii) Average production rate
(iii) Line efficiency **(06 Marks)**

Module-2

3 a. With block diagram, explain the various steps in computer aided design process. **(08 Marks)**

b. Explain the functions of a graphics package. **(06 Marks)**

c. Briefly explain Translation and Scaling. **(06 Marks)**

OR

4 a. Define Computer Aided Process Planning. List its benefits. **(06 Marks)**

b. With block diagram, explain variant type of CAPP system. **(08 Marks)**

c. What is shop floor control? Briefly explain the various phases of shop floor control. **(06 Marks)**

Module-3

5 a. With neat sketches, explain the types of FMS layouts. **(10 Marks)**

b. Explain in brief with diagram the structure of Automated Storage and Retrieval System. **(05 Marks)**

c. List the advantages of Group Technology. **(05 Marks)**

OR

6 a. Illustrate the following terms with reference to Line Balancing:
   (i) Minimum rational work element
   (ii) Precedence diagram
   (iii) Balance delay **(06 Marks)**

b. In a plant, a product is assembled as per the following data. Assume cycle time as 16 min:

Work element	1	2	3	4	5	6	7	8
T_e(min)	10	5	8	3	11	3	5	15
Preceded by	-	-	1, 2	2	3	3, 4	4	5, 6, 7

   (i) Construct precedence diagram
   (ii) Determine the number of stations required to balance the line by using LCR method.
   (iii) Determine balance delay. **(14 Marks)**

Module-4

7 a. Briefly explain the classifications of CNC system. **(06 Marks)**

b. Write a note on cutter radius compensation. **(06 Marks)**

c. Write the part program for the part shape shown in Fig.Q7(c). Assume suitable machining parameters.

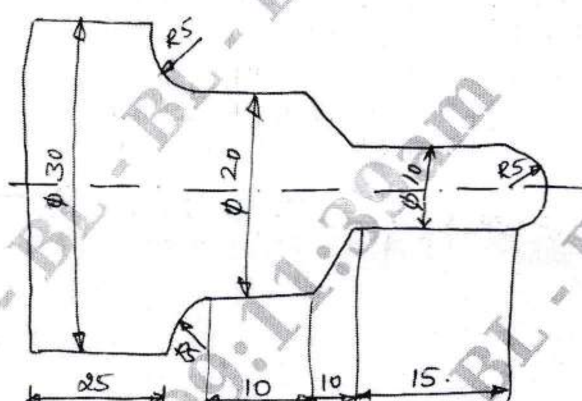


Fig.Q7(c) All dimensions are in mm **(08 Marks)**

OR

8 a. With sketches, explain any three configurations of Industrial Robot. **(12 Marks)**

b. Write a note on various sensors used in Industrial Robot. **(08 Marks)**

Module-5

9 a. With sketch, explain photopolymerization process. **(10 Marks)**

b. With sketch briefly explain Fused Deposition Modeling Technique. **(10 Marks)**

OR

10 a. Briefly explain the various components of Industry 4.0. **(10 Marks)**

b. Write a note on Smart Manufacturing as applied to Industry 4.0. **(10 Marks)**

* * * * *

CBCS SCHEME

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

18ME734

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024
Total Quality Management

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Make the list of the basic concepts of TQM and briefly explain them. **(10 Marks)**
b. Enlighten on TQM frame work with a neat diagram. **(10 Marks)**

OR

2 a. Differentiate between American and Japan's approach towards quality. **(10 Marks)**
b. Elucidate on quality from customer's/consumer's and producer's perspective with a block diagram. **(10 Marks)**

Module-2

3 a. Which are the 12 characteristics of quality leaders? Describe them. **(10 Marks)**
b. Explain briefly the seven characteristics of effective people. **(10 Marks)**

OR

4 a. List out Deming's 14 points of TQM philosophy and explain any 4 of them. **(10 Marks)**
b. With Time-Management matrix, briefly describe put first things first. **(10 Marks)**

Module-3

5 a. What is Kano model? Why it is used? Explain the salient features. **(10 Marks)**
b. Who is customer? Define internal and external customer, with an example for each type. **(10 Marks)**

OR

6 a. How do you differentiate between dissatisfied, satisfied and delighted customers articulate with a sketch? **(10 Marks)**
b. Elucidate on customer perception of quality. **(10 Marks)**

Module-4

7 a. Sketch and explain Juran's Triology. **(10 Marks)**
b. Explicate on Scatter diagram and cause and effect diagram with a neat figures. **(10 Marks)**

OR

8 a. Explain PDSA cycle for continuous improvement with a neat figure. **(10 Marks)**
b. Enlighten on Histogram, Pareto diagram with a sketch and evidences. **(10 Marks)**

Module-5

9 a. Lean out steps involved in introduction of TPM. **(10 Marks)**
b. List and mention importance of 5's. **(10 Marks)**

OR

10 a. Which are the 8 pillers of TPM? Describe them with a neat sketch. **(10 Marks)**
b. Differentiate between productive maintenance and predictive maintenance with a table. **(10 Marks)**

* * * * *

CBCS SCHEME

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

18ME741

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024
Additive Manufacturing

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Differentiate between CNC and Additive Manufacturing. **(10 Marks)**
b. Explain Additive Manufacturing Process Chain. **(10 Marks)**

OR

2 a. What is Additive Manufacturing? What are the benefits of AM? **(10 Marks)**
b. With a block diagram, explain general integration of AM machine. **(10 Marks)**

Module-2

3 a. With a neat sketch, explain photopolymerization process. **(10 Marks)**
b. What are benefits and drawbacks of use of photopolymerization technology? **(10 Marks)**

OR

4 a. With a neat sketch, explain Selective Laser Sintering (SLS) process. **(10 Marks)**
b. What is extrusion based system? With a neat sketch, explain Fused Deposition Modelling (FDM). **(10 Marks)**

Module-3

5 a. With a neat sketch, explain the working of Laminated Object Manufacturing (LOM). **(10 Marks)**
b. Write a note on research achievements in printing deposition process. **(10 Marks)**

OR

6 a. Explain with neat sketch, Beam Deposition Process. List advantages and limitations of the process. **(10 Marks)**
b. What is direct write technology? Explain Ink based direct write technology. **(10 Marks)**

Module-4

7 a. Write a note on selection methods for a part. **(10 Marks)**
b. Explain the following post processing operations:
(i) Support material removal
(ii) Surface texture improvements **(10 Marks)**

OR

8 a. Explain different types of problems that occur in STL file. **(10 Marks)**
b. Explain the following post processing operations :
(i) Accuracy improvements
(ii) Preparation for use as pattern **(10 Marks)**

Module-5

9 a. Write a note on AM applications in the field of
(i) Medical
(ii) Automobile **(10 Marks)**

b. Write a note on:
(i) Align technology
(ii) Siemens and phonak hearing **(10 Marks)**

OR

10 a. Write a note on AM applications in the field of
(i) Aerospace
(ii) Industrial design **(10 Marks)**

b. Write a note on:
(i) Life cycle Costing
(ii) Future of direct digital marketing **(10 Marks)**

* * * * *

CBCS SCHEME

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

18ME751

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024
Energy and Environment

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. With relevant statistics enumerate the primary energy production trend in India. **(10 Marks)**
b. List and explain various forms of energy in a brief manner. **(05 Marks)**
c. Define energy management and explain energy demand estimation. **(05 Marks)**

OR

2 a. Elaborate the effect of various social and environmental aspects of India's energy development. **(10 Marks)**
b. Define energy and power. Differentiate the same. **(05 Marks)**
c. Interpret world energy scenario with respect to production and consumption using relevant statistics. **(05 Marks)**

Module-2

3 a. Define and explain sensible heat storage methods. **(10 Marks)**
b. Explain in detail various phases of energy audit methodology. **(10 Marks)**

OR

4 a. Define and explain Latent heat storage methods. **(10 Marks)**
b. Define energy audit and explain the need for energy audit. **(05 Marks)**
c. Elaborate the benefits of thermal energy storage. **(05 Marks)**

Module-3

5 a. Define ecosystem and explain the following term :
i) Food chain
ii) Food web
iii) Ecological pyramid. **(10 Marks)**
b. Enumerate how carbon cycle is utilized in the ecosystem. **(05 Marks)**
c. Discuss how oxygen cycle is utilized in the ecosystems. **(05 Marks)**

OR

6 a. Define environment. Mention its scope. Discuss need for public awareness. **(10 Marks)**
b. Elaborate how the nitrogen cycle ecosystem operates. **(05 Marks)**
c. Discuss how water cycle is utilized in the ecosystem. **(05 Marks)**

Module-4

7 a. Discuss solid waste management techniques. (10 Marks)
b. Discuss briefly the causes effects and control measure of air pollution. (10 Marks)

OR

8 a. Enumerate the role of an individual in prevention of pollution. (10 Marks)
b. Enumerate the water pollution cases and its effects. Mention the control measures that can be initiated for mitigating the same. (10 Marks)

Module-5

9 a. Write a note on ozone layer depletion. (10 Marks)
b. Explain the role of Environment Impact Assessment (EIA) in reinforcing environmental legislation. (10 Marks)

OR

10 a. Discuss :
i) Wildlife Projection Act
ii) Forest Conservation Act. (10 Marks)
b. Enumerate the impact of global warming and acid rain on our mother nature. (10 Marks)

* * * * *

OR

4 a. Explain the Hungarian method for solving assignment problem. **(10 Marks)**

b. A Marketing Manager has five salesman and five sales districts. Considering the capabilities of the salesman and the nature of districts , the marketing Manager estimates that the sales per month (in hundred rupees) for each salesman in each district would be as follows :

Salesman \ Districts	A	B	C	D	E
1	32	38	40	28	40
2	40	24	28	21	36
3	41	27	33	30	37
4	22	38	41	36	36
5	29	33	40	35	39

Find the assignment of salesman to districts that will result in maximum sales. **(10 Marks)**

Module-3

5 a. Explain Gomory's all integer cutting plane method. **(10 Marks)**

b. Explain Branch and Bound method. **(10 Marks)**

OR

6 a. Explain the Pure – Birth and Pure – Death models. **(10 Marks)**

b. In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the interval time follows an exponential distribution and the service time (the time taken to hump a train) distribution is also exponential with an average of 36 minutes. Calculate

i) Expected queue size (line length).

ii) Probability that the queue size exceeds 10.

If the input of trains increases to an average of 33 per day, what will be the change in (i) and (ii)? **(10 Marks)**

Module-4

7 a. Differentiate between PERT and CPM. Mention the significance of using PERT / CPM. **(10 Marks)**

b. Explain the rules for AoA Network construction. **(10 Marks)**

OR

8 A small project involves 7 activities and their time estimates are listed in the following table. Activities are identified by their beginning (i) and ending (j) node numbers.

Activity (i – j)	Estimated duration (weeks)		
	Optimistic	Most likely	Pessimistic
1 - 2	1	1	7
1 - 3	1	4	7
1 - 4	2	2	8
2 - 5	1	1	1
3 - 5	2	5	14
4 - 6	2	5	8
5 - 6	3	6	15

(20 Marks)

Module-5

9 a. Define the following :
i) Competitive game ii) Payoff matrix iii) Pure and mixed strategies
iv) Saddle point v) Optimal strategies. **(10 Marks)**

b. Find the range of values of p and q that will render the entry (2, 2) a saddle point for the game.

	Player B		
Player A	B_1	B_2	B_3
A_1	2	4	5
A_2	10	7	q
A_3	4	p	6

(10 Marks)

OR

10 a. Explain the Johnson's procedure. **(10 Marks)**

b. Find an optimal sequence for the following sequencing problems of four jobs and five machines, when passing is not allowed. Its processing time (in hours) is given below :

Job	Machine				
	M_1	M_2	M_3	M_4	M_5
A	7	5	2	3	9
B	6	6	4	5	10
C	5	4	5	6	8
D	8	3	3	2	6

(10 Marks)

* * * * *

CBCS SCHEME

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

18ME752

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024
Automotive Engineering

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. What are the basic components of an automobile? Briefly explain them. **(08 Marks)**

b. Why cooling is necessary? What is the effect of over cooling and under cooling? **(05 Marks)**

c. What are the basic requirements of S.I. engine combustion chamber? How these requirements can be achieved? **(07 Marks)**

OR

2 a. Draw the valve timing diagram for 4 stroke S.I. engine and explain. **(06 Marks)**

b. Sketch and explain dry sump lubrication system. **(07 Marks)**

c. With a neat sketch explain the construction and purpose of dry and wet liners. **(07 Marks)**

Module-2

3 a. What is clutch? What are the requirements of clutch? **(05 Marks)**

b. With a neat sketch, explain the construction and working of hydraulic braking system. **(08 Marks)**

c. Explain the working of a over drive operation with a neat sketch. **(07 Marks)**

OR

4 a. What is a ABS? Explain the purpose and operation of ABS. **(05 Marks)**

b. Write a short note on propeller shaft. **(05 Marks)**

c. A passenger car with all when brakes weighing 1300 N makes an emergency stop at 96 km/hr. The rolling and air resistance at 96 km/hr is 820 N/Ton. The coefficient of adhesion is 0.5. Calculate:
(i) The retarding force if the brakes are applied at locking point.
(ii) Heat flow/sec at each wheel at the beginning of braking.
Assume that the distribution of braking force is equal on each wheel. **(10 Marks)**

Module-3

5 a. Define the following and explain their effect on steering:
(i) Camber
(ii) King pin angle or steering axis inclination
(iii) Included angle and scrub radius
(iv) Castor
(v) Toe in and toe out **(10 Marks)**

b. What is suspension system? What are the objectives of suspension system? **(04 Marks)**

c. Write the differences between battery ignition system and magneto ignition system. **(06 Marks)**

OR

6 a. With a neat sketch, explain the working of battery ignition system. **(08 Marks)**

b. Sketch and explain the working of electronic ignition system. **(07 Marks)**

c. Explain the working of air suspension system with a neat sketch. **(05 Marks)**

Module-4

7	a.	Explain the different methods of supercharging.	(08 Marks)
	b.	Distinguish between supercharging and turbocharging.	(07 Marks)
	c.	Write short notes on octane and cetane number.	(05 Marks)

OR

8	a.	With a neat sketch explain the working of turbocharger.	(07 Marks)
	b.	What are the air fuel mixture requirements for SI engine?	(05 Marks)
	c.	Sketch and explain Zenith carburetor.	(08 Marks)

Module-5

9	a.	Write a note on automotive emission control system.	(05 Marks)
	b.	With a neat sketch, explain the working of positive crank case ventilation system.	(07 Marks)
	c.	Sketch and explain the working of Exhaust Gas Recirculation (EGR) system.	(08 Marks)

OR

10		Write short note on the following:	
	a.	Catalytic converter	(07 Marks)
	b.	Emission standards	(06 Marks)
	c.	Evaporative Control System (ECS) for fuel injected engines	(07 Marks)

* * * * *

CBCS SCHEME

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

15ME835

Eighth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Product Life Cycle Management

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define PLM? Explain the different stages of PLM. **(08 Marks)**

b. Discuss and explain briefly the components of PLM. **(08 Marks)**

OR

2 a. Discuss and explain the steps involved in product life cycle model with a neat sketch. **(06 Marks)**

b. Summarize the five step process in implementing the PLM strategy. **(10 Marks)**

Module-2

3 a. With an example, discuss the various steps involved in engineering design. **(08 Marks)**

b. Discuss the role of concurrent engineering in Product design and development. **(08 Marks)**

OR

4 a. Write short notes on recycling. **(06 Marks)**

b. What is design for X and design – centered development model? **(10 Marks)**

Module-3

5 a. Sketch and explain the various activities of new product development. **(08 Marks)**

b. How do you estimate the market potential of a new product? Explain. **(08 Marks)**

OR

6 a. What is Decision Support System? How it is helpful in decision making? Explain. **(08 Marks)**

b. With the aid of a flow chart, explain the process of launching and tracking of a new product. **(08 Marks)**

Module-4

7 a. Explain briefly the elements of Technology forecasting. **(06 Marks)**

b. Define Technology forecasting. Explain briefly the methods of technology forecasting. **(10 Marks)**

OR

8 a. Discuss and explain briefly the importance of Relevance tree and mission flow diagram used in technology forecasting. **(08 Marks)**

b. Explain briefly the methodologies and tools involved in product innovation process. **(08 Marks)**

Module-5

9 a. What is Model building? How do you classify them? Explain. **(06 Marks)**

b. Explain the following :

i) Product structures

ii) Digital mock – up. **(10 Marks)**

OR

10 Explain the following :

a. Data model.

b. Product configuration.

c. 3D CAD systems.

d. Variant Management. **(16 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | |

15ME82

Eighth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Additive Manufacturing

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Briefly explain the process chain of additive manufacturing. (08 Marks)
b. Explain discrete particle system. (08 Marks)

OR

2 a. Explain the steps involved in property enhancement using thermal techniques. (08 Marks)
b. Write any eight applications of AM in Aerospace, Automobile, Medical and general engineering. (08 Marks)

Module-2

3 a. Explain electric DC motor with sketch. (10 Marks)
b. Explain relay in brief. (06 Marks)

OR

4 a. Explain regenerative hydraulic circuit with sketch. (08 Marks)
b. Explain shape memory alloy in brief. (08 Marks)

Module-3

5 a. List out the polymers used for AM process. Explain Dry spinning technique of polymer processing. (08 Marks)
b. Write a note on :
i) Biopolymer materials
ii) History of powder metallurgy (PM) process. (08 Marks)

OR

6 a. Sketch and explain Powder Extrusion process. (08 Marks)
b. Define Sintering process and explain Microwave Sintering process with neat sketch. (08 Marks)

Module-4

7 a. Explain the wet chemical synthesis in material technology. (08 Marks)
b. Explain chemical vapour condensation process in nanomaterial technology. (08 Marks)

OR

8 a. Explain scanning probe microscope. (08 Marks)
b. Explain transmission electron microscope. (08 Marks)

Module-5

9 a. Write a note on classifications of CNC machine tools. (08 Marks)
b. Explain the NC words used in manual part programming. (08 Marks)

OR

10 a. Define automation. Explain the levels of Automation. (08 Marks)
b. Write a note on Continuous and Discrete control. (08 Marks)

* * * * *

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

17ME81

Eighth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Operations Research

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Briefly explain the scopes of operation research. **(05 Marks)**

b. A farmer has a 100 acre farm. He can sell all tomatoes, lettuce or radishes and can rise the price to obtain Rs.1.00 per kg for tomatoes, Rs.0.75 ahead for lettuce and Rs.2.00 per kg for radishes. The average yield per acre is 2000 kgs of tomatoes, 3000 heads of lettuce and 1000 kgs of radishes. Fertilizers are available at Rs.0.50 per kg and amount required per acre is 100 kgs each for tomatoes and lettuce and 50 kgs for radishes, labour required for sowing, cultivating and harvesting per acre is 5 man-days for tomatoes and radishes and 6 man-days for lettuce. A total of 400 man days of labour are available at Rs.20 per man-day. Formulate this problem as a linear programming model to maximize the farmer's total profit. **(15 Marks)**

OR

2 a. Describe briefly the procedure of for solving LPP by graphical method. **(10 Marks)**

b. Solve the following LPP using graphical method.

Minimize $Z = 20x_1 + 10x_2$

Subject to $x_1 + 2x_2 \le 40$

$3x_1 + x_2 \ge 30$

$4x_1 + 3x_2 \ge 60$

$x_1, x_2 \ge 0$ **(10 Marks)**

Module-2

3 a. Define the following:

(i) Basic solution (ii) Feasible solution

(iii) Basic feasible solution (iv) Optimal solution **(04 Marks)**

b. Use Big-M method to solve the problem:

Maximize $Z = 6x_1 + 4x_2$

Subject to $2x_1 + 3x_2 \le 30$

$3x_1 + 2x_2 \le 24$

$x_1 + x_2 \ge 3$

$x_1, x_2 \ge 0$ **(16 Marks)**

OR

4 a. Obtain the dual of the following LP problem:

Minimize $Z = 2x_1 + 3x_2 + 4x_3$

Subject to $2x_1 + 3x_2 + 5x_3 \ge 2$

$3x_1 + x_2 + 7x_3 = 3$

$x_1 + 4x_2 + 6x_3 \le 5$

$x_1, x_2 \ge 0$ and x_3 is unrestricted **(06 Marks)**

b. Solve the following LPP by using two phase simplex method.

Maximize, $Z = 3x_1 + 2x_2 + 2x_3$

Subject to, $5x_1 + 7x_2 + 4x_3 \leq 7$

$-4x_1 + 7x_2 + 5x_3 \geq -2$

$3x_1 + 4x_2 - 6x_3 \geq \frac{29}{7}$

$x_1, x_2, x_3 \geq 0$

(14 Marks)

Module-3

5 A company manufacturing air coolers has two plants located at Bombay and Calcutta with a capacity of 200 units and 100 units per week respectively. The company supplies the air coolers to its four showrooms situated at Ranchi, Delhi, Lucknow and Kanpur, which have a maximum demand of 75, 100, 100 and 30 units respectively. Due to difference in raw material cost and transportation cost, the profit per unit in rupees differs, which is shown in the table below:

	Ranchi	Delhi	Lucknow	Kanpur
Bombay	90	90	100	110
Calcutta	50	70	130	85

Plan the production program so as to maximize the problem. **(20 Marks)**

OR

6 A textile firm has three factories F_1, F_2 and F_3 and four ware-houses W_1, W_2, W_3 and W_4. The transportation cost, factory capacity and warehouse requirement are given in the following table. Find the optimal transportation cost.

	W_1	W_2	W_3	W_4	Capacity
F_1	15	24	11	12	500
F_2	25	20	14	16	400
F_3	12	16	22	13	700
Requirement	300	250	350	400	

(20 Marks)

Module-4

7 a. Define:

(i) Critical activity and critical path

(ii) Total float

(iii) Free float **(06 Marks)**

b. An R and D activity has activities for which the three time estimates are given below along with its preceding activity.

Activity	Preceding activity	Optimistic time (a)	Most likely time (m)	Pessimistic time (b)
A	-	4	6	8
B	A	6	10	12
C	A	8	18	24
D	B	9	9	9
E	C	10	14	18
F	A	5	5	5
G	D, E, F	8	10	12

(i) Draw PERT network.

(ii) Find EST, LST and Slack for each node.

(iii) Find critical path and expected project duration. **(14 Marks)**

OR

8 a. What is queue discipline? List the various queue discipline. **(05 Marks)**

b. At what average rate must a clerk at a supermarket work in order to ensure a probability of 0.9 that the customer will not have to wait longer than 12 minutes? It is assumed that there is only one counter to which customer arrive in a Poisson fashion at an average rate of 15 hr. The length of the service by the clerk has an exponential distribution. **(07 Marks)**

c. In a hair dress by saloon with one barber, the customer arrival follows Poisson distribution at an average rate of one every 45 minutes. The service time is exponentially distributed with a mean of 30 minutes. Find:

(i) Average number of customers in a saloon.
(ii) Average waiting time of a customer before service.
(iii) Average idle time of barber. **(08 Marks)**

Module-5

9 Players A and B play a game in which each player has three coins (20P, 25P and 50P). Each of them selects a coin without the knowledge of the other player. If the sum of the values of the coins is an even number, A wins B's coin. If the sum is an odd number, B wins A's coin.

(i) Develop a payoff matrix, with respect to player A.
(ii) Find the optimal strategies for the players. What is the value of the game? **(20 Marks)**

OR

10 a. Explain the assumptions made while solving sequencing problems. **(05 Marks)**

b. Find the sequence that minimizes the total elapsed time 'T' required to complete the following tasks. Each task can be processed in any two machines A, B and C in any order.

	Tasks	1	2	3	4	5	6	7
Machines	A	12	6	5	3	5	7	6
	B	7	8	9	8	7	8	3
	C	3	4	11	5	2	8	4

(15 Marks)

* * * * *

CBCS SCHEME

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

17ME82

Eighth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Additive Manufacturing

Time: 3 hrs. Max. Marks: 100

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

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

Module-1

1 a. Explain briefly the post processing of additive manufacturing parts. **(10 Marks)**

b. Explain the merits, limitations and applications of AM. **(10 Marks)**

OR

2 a. List out the classification of AM process. Explain the following :
(i) Liquid polymer system (ii) Molten material system **(10 Marks)**

b. Explain briefly the process chain of additive manufacturing. **(10 Marks)**

Module-2

3 a. With a neat sketch, explain the working of following hydraulic motors :
(i) External gear motor (ii) Balanced vane motor. **(10 Marks)**

b. Explain in detail the working of single acting and double acting hydraulic cylinders. **(10 Marks)**

OR

4 a. Explain the applications of AM products in the field of aerospace and biomedical industries. **(10 Marks)**

b. Explain with a sketch the following DC motors ;
(i) Permanent magnet DC motor.
(ii) Series wound DC motors.
(iii) Shunt wound DC motors. **(10 Marks)**

Module-3

5 a. Describe briefly the various steps involved in powder metallurgy. List the merits and limitations of powder metallurgy. **(10 Marks)**

b. Define sintering process and explain the microwave sintering process with a neat sketch. **(10 Marks)**

OR

6 a. Write a note on : (i) Bio polymers (ii) History of powder metallurgy process. **(10 Marks)**

b. List and explain briefly the various methods of powder production techniques. **(10 Marks)**

Module-4

7 a. Discuss briefly the merits, limitations and applications of Nano-Technology. **(10 Marks)**

b. Explain the bottom up and top down methods of synthesis. **(10 Marks)**

OR

8 a. Explain in detail the wet chemical synthesis of Nano-Materials-Sol-gel process. **(10 Marks)**

b. Explain with a neat sketch, the construction and working principle of optical microscopy. List out the merits and limitations of optical microscope. **(10 Marks)**

Module-5

9 a. Define Automation. Explain briefly the various strategies of automation. **(10 Marks)**

b. Write a note on classifications of CNC machine tools. Distinguish between CNC over NC machines. **(10 Marks)**

OR

10 a. Explain the general configuration of NC system with a neat block diagram. **(10 Marks)**

b. Explain the following :

(i) Continuous control system (ii) Discrete control system

(iii) Open and closed loop control systems. **(10 Marks)**

* * * * *

CBCS SCHEME

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

17ME835

Eighth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Product Life Cycle Management

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define PLM. Explain briefly the life cycle model. **(10 Marks)**

b. List and explain the different phases of product life cycle. **(10 Marks)**

OR

2 a. What is PLM Strategy? Explain in detail all Elements of Strategy. **(10 Marks)**

b. What is Product Data Management? List the various advantages and disadvantages of PDM. **(10 Marks)**

Module-2

3 a. With the help of a neat sketch, explain the product design process. **(10 Marks)**

b. Explain briefly the phases in morphology of design. **(10 Marks)**

OR

4 a. Explain the different strategies for a recovery at the end of life of product. **(08 Marks)**

b. Write a short note on modeling and simulation in product design. **(06 Marks)**

c. Describe the recycling and human factors in product design. **(06 Marks)**

Module-3

5 a. What is NPD? Explain the various stages of new product development process. **(10 Marks)**

b. What is building decision support system? How it is helpful in decision making? Explain. **(10 Marks)**

OR

6 a. Discuss the various components used in building decision support system. **(10 Marks)**

b. Explain the process of launching and tracking of new product. **(10 Marks)**

Module-4

7 a. Define technology forecasting. Explain why technology forecasting is important. **(10 Marks)**

b. List and explain any one method of technology forecasting. **(10 Marks)**

OR

8 a. Sketch and explain the importance of 'Relevance Tree' by taking automobile as an example. **(10 Marks)**

b. List and explain the importance of ideation tools in the innovation process. **(10 Marks)**

Module-5

9 a. Discuss the need and benefits of virtual product development. **(08 Marks)**

b. Discuss the 3D CAD system and digital mock-up tools used in virtual product development. **(12 Marks)**

OR

10 a. With an example, discuss the role of product structure in virtual product development. **(10 Marks)**

b. Explain product data description and data models

CBCS SCHEME

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

18ME81

Eighth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Energy Engineering

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. List and explain the steps in Coal Handling. **(10 Marks)**
b. Describe with a neat sketch La Mont Boiler and list advantages. **(10 Marks)**

OR

2 a. Describe with a neat sketch, Natural Draught Cooling tower. List the advantages. **(10 Marks)**
b. Summarize : i) Super heater ii) Economizer iii) De Superheater iv) Air preheater. **(10 Marks)**

Module-2

3 a. Describe the Solar radiation at Earths surface with direct and diffuse solar radiation. **(10 Marks)**
b. Summarize the components of Flat Plate Collectors, with neat sketch. **(10 Marks)**

OR

4 a. Explain with a neat sketch, KVIC type of Biogas plant and list advantages. **(10 Marks)**
b. Explain with a neat sketch, Fixed dome type ϕ biogas plant and list advantages. **(10 Marks)**

Module-3

5 a. List and describe the categories of forms of geothermal energy. **(10 Marks)**
b. Outline Single basin and Double basin system. **(10 Marks)**

OR

6 a. List and explain the Basic components of Wind Energy Conversion System. **(10 Marks)**
b. Describe the working of Horizontal axis type wind mills and list advantages. **(10 Marks)**

Module-4

7 a. Summarize : i) Flow duration curve ii) Storage and Pondage. **(10 Marks)**
b. Outline the general layout of Hydel Power plants. **(10 Marks)**

OR

8 a. Summarize : i) Water Hammer ii) Problem with OTEC. **(10 Marks)**
b. Describe with a neat block diagram, principle of OTEC with Rankine cycle. **(10 Marks)**

Module-5

9 a. Describe Fusion and Fission reactions. **(10 Marks)**
b. Outline : i) Nuclear fuels ii) Breeding. **(10 Marks)**

OR

10 a. Describe Boiling water reactor and list the advantages. **(10 Marks)**
b. Summarize : i) Shielding ii) Radioactive waste disposal. **(10 Marks)**

* * * * *