CBCS SCHEME

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17MAT31

Third Semester B.E. Degree Examination, June/July 2019
Engineering Mathematics – III

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Obtain the fourier series of the function $f(x) = x - x^2$ in $-\pi \le x \le \pi$ and hence deduce $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \ldots\ldots\ldots$ **(08 Marks)**

b. Obtain the Half Range Fourier cosine series for the $f(x) = \sin x$ in $[0, \pi]$. **(06 Marks)**

c. Obtain the constant term and the coefficients of first sine and cosine terms in the fourier expansion of y given

x :	0	1	2	3	4	5
y :	9	18	24	28	26	20

(06 Marks)

OR

2 a. Obtain the fourier series of $f(x) = \frac{\pi - x}{2}$ in $[0, 2\pi]$ and hence deduce that $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots\ldots\ldots$ **(08 Marks)**

b. Find the fourier half range cosine series of the function $f(x) = 2x - x^2$ in $[0, 3]$. **(06 Marks)**

c. Express y as a fourier series upto first harmonic given

x :	0	30	60	90	120	150	180	210	240	270	300	330
y :	1.8	1.1	0.30	0.16	1.5	1.3	2.16	1.25	1.3	1.52	1.76	2.0

(06 Marks)

Module-2

3 a. Find the fourier transform of $f(x) = \begin{cases} a^2 - x^2 ; & |x| \le a \\ 0 ; & |x| > a \end{cases}$ and hence deduce $\int_0^a \frac{\sin x - x\cos x}{x^3}\,dx = \frac{\pi}{4}$ **(08 Marks)**

b. Find the fourier sine transform of $e^{-|x|}$ and hence evaluate $\int_0^\infty \frac{x \sin ax}{1+x^2}\,dx ; a > 0$ **(06 Marks)**

c. Obtain the z-transform of $\cos n\theta$ and $\sin n\theta$. **(06 Marks)**

OR

4 a. Find the fourier transform of $f(x) = xe^{-|x|}$. **(08 Marks)**

b. Find the fourier cosine transform of f(x) where

$$f(x) = \begin{cases} x ; & 0 < x < 1 \\ 2 - x ; & 1 < x < 2 \\ 0 ; & x > 2 \end{cases}$$

(06 Marks)

c. Solve $u_{n+2} + 6u_{n+1} + 9u_n = 2^n$ with $u_0 = u_1 = 0$ using z-transform. **(06 Marks)**

Module-3

5 a. Fit a straight line $y = ax + b$ for the following data by the method of least squares.

x :	1	3	4	6	8	9	11	14
y :	1	2	4	4	5	7	8	9

(08 Marks)

b. Calculate the coefficient of correlation for the data:

x :	92	89	87	86	83	77	70	63	53	50
y :	86	83	91	77	68	85	54	82	37	57

(06 Marks)

c. Compute the real root of $x\log_{10}x - 1.2 = 0$ by the method of false position. Carry out 3 iterations in (2, 3). **(06 Marks)**

OR

6 a. Fit a second degree parabola to the following data $y = a + bx + cx^2$

x :	1	1.5	2	2.5	3	3.5	4
y :	1.1	1.3	1.6	2	2.7	3.4	4.1

(08 Marks)

b. If θ is the angle between two regression lines, show that

$\tan\theta = \left(\frac{1-r^2}{r}\right)\frac{\sigma_x\sigma_y}{\sigma_x^2+\sigma_y^2}$; explain significance of $r = 0$ and $r = \pm 1$. **(06 Marks)**

c. Using Newton Raphson method, find the real root of the equation $3x = \cos x + 1$ near $x_0 = 0.5$. Carry out 3 iterations. **(06 Marks)**

Module-4

7 a. From the following table, estimate the number of students who obtained marks between 40 and 45.

Marks :	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80
No. of students	31	42	51	35	31

(08 Marks)

b. Use Newton's dividend formula to find f(9) for the data:

x :	5	7	11	13	17
f(x) :	150	392	1452	2366	5202

(06 Marks)

c. Find the approximate value of $\int_0^{\pi/2}\sqrt{\cos\theta}\,d\theta$ by Simpson's $\frac{1}{3}^{rd}$ rule by dividing $\left[0, \frac{\pi}{2}\right]$ into 6 equal parts. **(06 Marks)**

OR

8 a. The area A of a circle of diameter d is given for the following values:

d :	80	85	90	95	100
a :	5026	5674	6362	7088	7854

Calculate the area of circle of diameter 105 by Newton's backward formula. **(08 Marks)**

b. Using Lagrange's interpolation formula to find the polynomial which passes through the points (0, –12), (1, 0), (3, 6), (4, 12). **(06 Marks)**

c. Evaluate $\int_4^{5.2}\log_e x\,dx$ taking 6 equal parts by applying Weddle's rule. **(06 Marks)**

Module-5

9 a. If $\vec{F} = 3xy\,\hat{i} - y^2\,\hat{j}$, evaluate $\int_C \vec{F}.d\vec{r}$ where 'C' is arc of parabola $y = 2x^2$ from (0, 0) to (1, 2) **(08 Marks)**

b. Evaluate by Stokes theorem $\oint_C (\sin z\,dx - \cos x\,dy + \sin y\,dz)$, where C is the boundary of the rectangle $0 \le x \le \pi$; $0 \le y \le 1$, $z = 3$ **(06 Marks)**

c. Prove that the necessary condition for the $I = \int_{x_1}^{x_2} f(x, y, y')dx$ to be extremum is $\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$ **(06 Marks)**

OR

10 a. Using Green's theorem evaluate $\int_C (3x^2 - 8y^2)dx + (4y - 6xy)dy$, where C is the boundary of the region bounded by the lines $x = 0$, $y = 0$, $x + y = 1$. **(08 Marks)**

b. Find the external value of $\int_0^{\pi/2} [(y')^2 - y^2 + 4y\cos x]dx$. Given that $y(0) = 0$, $y\left(\frac{\pi}{2}\right) = 0$. **(06 Marks)**

c. Prove that the shortest distance between two points in a plane is along a straight line joining them. **(06 Marks)**

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CBCS SCHEME

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17ME32

Third Semester B.E. Degree Examination, June/July 2019
Material Scinece

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define Atomic Packing Factor and calculate Atomic Packing Factor for FCC Crystal Structure. **(08 Marks)**

b. State and explain Ficks first law of Diffusion. **(06 Marks)**

c. Explain the different types of Point Imperfections, with neat sketches. **(06 Marks)**

OR

2 a. Draw Stress – Strain diagram for mild steel and caste iron. Explain its behaviour under uniaxial Tension until fracture. **(08 Marks)**

b. What is Fracture? How are they classified? **(04 Marks)**

c. With a neat sketch, explain the different stages of creep deformation. **(08 Marks)**

Module-2

3 a. With a neat sketch, explain the construction of phase diagram. **(08 Marks)**

b. Explain Gibbs phase rule and Lever rule. **(06 Marks)**

c. With a neat sketch, explain different cast metal structures. **(06 Marks)**

OR

4 a. Explain Homogeneous nucleation and discuss the significance of critical radius of nuclei. **(10 Marks)**

b. Two metals A & B of melting points 900^0C and 700^0C respectively have unlimited mutual liquid solubilities. The solid solubility of B in A is 30% at eutectic temperature of 400^0C, which reduces to 20% at 0^0C. The solid solubility of A in B is 20% at eutectic temperature which reduces to 15% at 0^0C. The eutectic composition is 70%B and 30% A. Draw the phase diagram. Calculate the solid and liquid phases of 40% B alloy at 500^0C. **(10 Marks)**

Module-3

5 a. Draw TTT diagram for eutectoid steel (0.83% C) and explain different micro structures. **(08 Marks)**

b. Sketch and explain Austempering and Martempering. **(08 Marks)**

c. Sketch and explain Flame hardening. **(04 Marks)**

OR

6 a. Define and list the types of Heat Treatment processes. **(05 Marks)**

b. With a neat sketch, explain Joming End Queuch test. **(08 Marks)**

c. Sketch and explain Nitriding process. **(07 Marks)**

Module-4

7 a. Define Ceramics and briefly explain the types of ceramics. **(08 Marks)**

b. Explain Powder Metallurgy technique for Ceramic processing. **(08 Marks)**

c. Differentiate between Thermoplastics and Thermoset plastics. **(04 Marks)**

OR

8 a. Briefly explain the characteristics of plastics. **(05 Marks)**

b. Define Smart Materials. Write a note on Piezoelectric materials. **(05 Marks)**

c. Write a note on Shape Memory alloys. List the Applications of Smart Materials. **(10 Marks)**

Module-5

9 a. Define Composites and classify them. **(05 Marks)**

b. Sketch and explain Filament winding process to produce composites. **(08 Marks)**

c. Write a note on Fibre reinforced plastic composites. **(07 Marks)**

OR

10 a. Derive an expression for Young's Modulus in a composite for longitudinal loading of fibre reinforced composite. **(08 Marks)**

b. Calculate the volume ratio of Aluminum and Boron in Aluminum – Boron composite having Young's Modulus equal to Iron. The Young's Moduli of Aluminum , Boron and Iron are respectively 71 GPa , 440 GPa and 210 GPa. **(08 Marks)**

c. State some Applications of composites. **(04 Marks)**

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CBCS SCHEME

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17ME33

Third Semester B.E. Degree Examination, June/July 2019
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 data hand book permitted.

Module-1

1 a. With examples briefly describe the terms:
i) Macroscopic approach
ii) Intensive properties
iii) Closed systems
iv) Quasistatic process. **(08 Marks)**

b. Define Zeroth law of thermodynamics and explain the concept of temperature measurement. **(04 Marks)**

c. A platinum wire is used as resistance thermometer. The wire resistance was found to be 10Ω and 16Ω at ice and steam points respectively and 30Ω at sulphur boiling point 444.6°C. Find the constants a and b in the equation $R = R_0 (1 + at + bt^2)$ where t in °C. Also find the resistance of the wire at 500°C. **(08 Marks)**

OR

2 a. Describe the similarities and dissimilarities between work and heat transfer. **(06 Marks)**

b. With the help of p-v diagrams, derive expressions for p-dv work for i) isothermal process ii) Polytropic process. **(06 Marks)**

c. A gas is initially at 100kPa and 6000 cm^3. The final volume is 2000 cm^3. Determine the moving boundary work for each of the following processes:
i) When P is proportional to V
ii) When P is inversely proportional to V
iii) PV^2 = constant. **(08 Marks)**

Module-2

3 a. With a neat sketch, explain Joule's experiment and hence define first law of thermodynamics. **(06 Marks)**

b. Briefly describe internal energy as a property of the system. **(04 Marks)**

c. Write SFEE and explain the terms. **(02 Marks)**

d. A steam nozzle is supplied with 40kg/min of steam at 15 bar. At the inlet V_1 = 1800m/min and v_1 = 0.15 m^3/kg, u_1 = 2600 kJ/kg and corresponding values at the exit are p_2 = 1 bar, v_2 = 1.7m^3/kg and u_2 = 2520 kJ/kg. Calculate the exit velocity. **(08 Marks)**

OR

4 a. Briefly explain the terms:
i) Thermal reservoir
ii) Refrigerator
iii) Heat pump
iv) Clausius statement of II law. **(08 Marks)**

b. With the help of p-v diagram, derive an expression for the efficiency of a Carnot cycle. **(06 Marks)**

c. A reversible engine with 40% efficiency discharges 1520 kJ of heat per minute at 27°C to a pond. Find the temperature of the source which supplies the heat to the engine and power developed by the engine. **(06 Marks)**

Module-3

5 a. Define the terms:
   i) Reversible process
   ii) Reversible heat engine
   iii) Irreversible process. **(06 Marks)**

b. Describe with a sketch heat transfer through a finite temperature difference is irreversible. **(06 Marks)**

c. A reversible heat engine operates between two reservoirs at temperatures of 600°C and 40°C. The engine drives a reversible refrigerator which operates between reservoirs at temperatures of 40°C and -20°C. The heat transfer to the engine is 2000kJ and the network output of the engine refrigerator plant is 360kJ. Evaluate the heat transfer to the refrigerant and net heat transfer to the reservoir at 40°C. **(08 Marks)**

OR

6 a. With p-v diagram explain Clausius inequality. **(06 Marks)**

b. Explain the principle of increase of entropy. **(04 Marks)**

c. Show that entropy is the property of a system. **(04 Marks)**

d. 10 gram of water at 20°C is converted into ice at -10°C in a constant pressure process of 1 atmosphere. Calculate the change in entropy for the process. Take cp_{water} = 4.187 kJ/kg K, cp_{ice} = 2.093 kJ/kg K, LH of ice = 335 kJ/kg. **(06 Marks)**

Module-4

7 a. Represent available and unavailable energy as referred to a cycle with T-S diagrams. **(06 Marks)**

b. Explain the concept of second law efficiency. **(06 Marks)**

c. Calculate the decrease in available energy when 25kg of water at 95°C mix with 35kg of water at 35°C at constant pressure and the temperature of the surroundings being 15°C (Take cpw = 4.2 kJ/kgK). **(08 Marks)**

OR

8 a. Explain the terms:
   i) Triple point
   ii) Critical point
   iii) Sub cooled liquid
   iv) Quality of steam. **(06 Marks)**

b. With a neat sketch and h-s diagram explain throttling calorimeter. **(06 Marks)**

c. A vessel of volume 0.04m^3 contains a mixture of saturated water and saturated steam at a temperature of 250°C. The mass of the liquid present is 9kg. Find the pressure, mass, specific volume, enthalpy, entropy and internal energy. **(08 Marks)**

Module-5

9 a. Define:
   i) Dalton's law of partial pressure.
   ii) Amagt's law of additive volume
   iii) Ideal gas **(06 Marks)**

   b. Derive an expression for the change in entropy of an ideal gas. **(04 Marks)**

   c. A gaseous mixture consists of 1kg of oxygen and 2kg of nitrogen at a pressure of 150kPa and a temperature of 20°C. Find:
   i) Gas constant
   ii) Molecular weight of the mixture
   iii) Mole Fractions
   iv) Partial pressures
   v) Specific heats of the mixture. **(10 Marks)**

OR

10 a. Define:
   i) Law of corresponding states
   ii) Compressibility factor
   iii) Real Gas. **(06 Marks)**

   b. Write Vander Waal's equation of state and express the constants in terms of critical properties. **(06 Marks)**

   c. The specific volume of CO_2 is $1 m^3/kg$ at 100°C. Determine the pressure exerted by CO_2 using Vander Waal's equation and compare the results obtained if CO_2 is treated as an ideal gas. **(08 Marks)**

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CBCS SCHEME

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17ME/MA34

Third Semester B.E. Degree Examination, June/July 2019
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. State the Hooke's Law. Neatly draw the stress – strain diagram for steel indicating all salient points and zones on it. **(05 Marks)**

b. Derive an expression for the extension of uniformly tapering circular bar subjected to axial load. **(05 Marks)**

c. A steel bar ABCD of varying sections is subjected to the axial forces as shown in fig.Q1(c). Find the value of P necessary for equilibrium. If E = 210 kN/mm^2, determine
i) Stress in various segments ii) Total elongation of bar. **(10 Marks)**

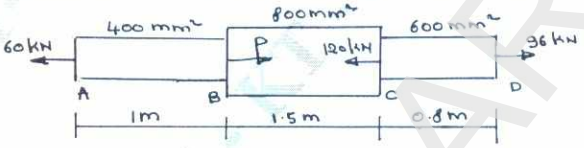


Fig.Q1(c)

OR

2 a. A compound bar is made up of a central aluminium plate 24mm wide and 6mm thick to which steel plates of 24mm wide and 9mm thick are connected rigidly on each side. The length of compound bar at temperature 20^{0}C is 100mm. If the temperature of the whole assembly is raised by 60^{0}C, determine the stress in each of the material. If at the new temperature a compressive load of 20kN is applied to the composite bar. What are the final stresses in steel and aluminum?

Given $E_S = 2 \times 10^5$ N/mm^2 , $E_A = \frac{2}{3} \times 10^5$ N/mm^2 , **(12 Marks)**

$\alpha_S = 12 \times 10^{-6}$ / ^{0}C and $\alpha_A = 23 \times 10^{-6}$ / ^{0}C.

b. Establish a relationship between the modulus of elasticity and modulus of rigidity. **(08 Marks)**

Module-2

3 a. Define i) Principal stress ii) Principal strain. **(04 Marks)**

b. At a certain point in a strained material the stress condition shown in fig. Q3(b) exists. Find
i) Normal and shear stress on the inclined plane AB.
ii) Principal stresses and principal planes.
iii) Maximum shear stresses and their planes. **(16 Marks)**

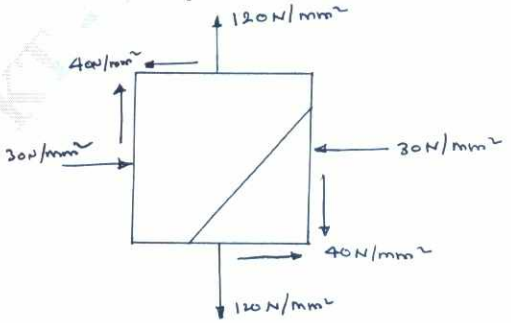


Fig.Q3(b)

OR

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

b. List the difference between thin and thick cylinders. **(02 Marks)**

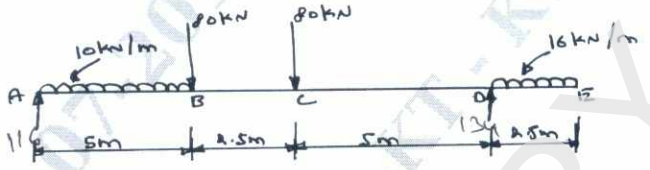
c. A thick cylinder pipe of outside diameter 300mm and internal diameter 200mm is subjected to an internal fluid pressure $20N/mm^2$ and external fluid pressure of $5N/mm^2$. Determine the maximum hoop stress developed. Draw the variation of hoop stress and radial stress across the thickness indicating the values at every 25mm interval. **(10 Marks)**

Module-3

5 a. What are different types of beams? Explain briefly. **(05 Marks)**

b. Draw shear force and bending moment diagrams for the beam shown in fig. Q5(b). Locate point of contra flexure if any. **(15 Marks)**

Fig.Q5(b)



OR

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

b. A cantilever has a length of 3m. Its cross – section is of T – section with flange 100mm × 20mm and web 200mm × 12mm, the flange is in tension. What is the intensity of UDL that can be applied if the maximum tensile stress is limited to $30N/mm^2$? Also compute the maximum compressive stress. **(10 Marks)**

Module-4

7 a. What are the assumption made in theory of pure torsion? **(02 Marks)**

b. Derive torsion equation with usual notations. **(08 Marks)**

c. A solid circular shaft has to transmit a power of 1000 kW at 120 rpm. Find the diameter of the shatt, if the shear stress of the material must not exceed $80N/mm^2$. The maximum torque 1.25 times of its mean. What percentage of saving in material would be obtained if the shatt is replaced by a hollow one whose internal diameter is 0.6 times its external diameter, the length , material and maximum shear stress being same. **(10 Marks)**

OR

8 a. Derive an expression for the critical load in a column subjected to compressive load, when both the ends are hinged. Also mention the assumptions made in the derivation. **(10 Marks)**

b. Design the section of a circular cast iron column that can safety carry a load of 1000kN. The length of the column is 6 meters. Rankine's constant is 1/1000 , factor of safety is 3. One end of the column is fixed and other end is free. Critical stress is 560 MPa. **(10 Marks)**

Module-5

9 a. State Castiglione's theorem I and II. **(04 Marks)**

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

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

OR

10 a. Explain Maximum principal stress theory and Maximum shear stress theory. **(10 Marks)**

b. The stress induced at a critical point in a machine component made of steel are as follows : $\sigma_x = 100N/mm^2$, $\sigma_y = 40N/mm^2$, $\tau_{xy} = 80N/mm^2$. Calculate the factor of safety by
i) Maximum shear stress theory ii) Maximum normal stress theory. **(10 Marks)**

CBCS SCHEME

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17ME35A

Third Semester B.E. Degree Examination, June/July 2019
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. Explain briefly the basic steps involved in sand casting process. **(04 Marks)**

b. Define Pattern. List the pattern materials and explain any 2 pattern materials. **(08 Marks)**

c. Discuss the characteristics of molding sand. **(08 Marks)**

OR

2 a. With a suitable sketch, explain the following terms:
i) Sprue ii) Pouring basin iii) Runner iv) Ingates v) Riser. **(10 Marks)**

b. With a neat diagram briefly explain investment casting. **(10 Marks)**

Module-2

3 a. Briefly explain hot chamber pressure die-casting with a neat sketch. **(10 Marks)**

b. Draw coreless induction furnace and explain in brief state the advantages. **(10 Marks)**

OR

4 a. With a neat diagram, explain various zones in cupola furnace. Write the reactions taking places in each zone. **(10 Marks)**

b. Draw and explain the following: i) Continuous casting ii) Centrifugal casting. **(10 Marks)**

Module-3

5 a. Define the following terms:
i) Growth and Nucleation in solidification.
ii) Homogeneous and Heterogeneous nucleation. **(08 Marks)**

b. Briefly explain directional solidification and progressive solidification with neat sketch. **(08 Marks)**

c. Define solidification. Explain the concept of solidification in casting. **(04 Marks)**

OR

6 a. Define degasification. Classify degasification process. Explain any 2 methods of degasification. **(10 Marks)**

b. List the casting defects. Discuss various methods to reduce the defects. **(10 Marks)**

Module-4

7 a. With a neat sketch explain TIG welding and state advantages and disadvantages of TIG welding. **(10 Marks)**

b. Describe Atomic Hydrogen Welding (AHW) briefly with a neat diagram. **(10 Marks)**

OR

8 a. With a neat sketch describe thermit welding and state the advantages. **(10 Marks)**

b. Explain briefly with a neat sketch Laser Beam welding. State the application. **(10 Marks)**

Module-5

9 a. Describe Heat Effected Zone (HAZ). Discuss the parameters affecting HAZ. **(10 Marks)**

b. List wielding defects. Explain any 5 defects with its cause and remedies. **(10 Marks)**

OR

10 a. With neat sketch explain magnetic particle inspection and florescent particle inspection. **(10 Marks)**

b. Draw and explain different types of flames in oxy-acetylene welding process. **(10 Marks)**

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