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VTU Question Papers

BE - ME

III to VIII Semester

Jul/Aug -2022

2018 Scheme

Maharaja Institute of Technology Thandavapura

Just of NH-766,Mysore-ooty highway,Thandavapura(Vill & Post),Nanjangud Taluk,Mysore District-571302.

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CBCS SCHEME

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

18ME15/25

First/Second Semester B.E. Degree Examination, July/August 2022
Elements of Mechanical Engineering

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain renewable and non-renewable energy sources with suitable examples. **(06 Marks)**

b. Sketch and explain the working principle of flat-plate collector. **(10 Marks)**

c. What are the differences between fossil fuels and bio-fuels? **(04 Marks)**

OR

2 a. Define Zeroth law, First law and Second law of thermodynamics. **(06 Marks)**

b. With a neat sketch, explain the process of formation of steam. **(06 Marks)**

c. Find the enthalpy and specific volume of 1 kg of steam at 8 bar. The dryness fraction is 0.9, superheated steam temperature is 300°C and the specific heat of the steam is 2.25 kJ/kg°K. Assume T_S = 170.4 °C, V_S = 0.2403 m^3/kg, V_f = 0.001115 m^3/kg, h_f = 720.94 kJ/kg, h_{fg} = 2046.5 kJ/kg, h_g = 2767.5 kJ/kg. **(08 Marks)**

Module-2

3 a. With a neat sketch, explain the construction and working of Babcock and Wilcox boiler. **(12 Marks)**

b. List the boiler mountings and accessories by mentioning their functions. **(08 Marks)**

OR

4 a. Sketch and explain the working principle of Pelton wheel turbine. **(08 Marks)**

b. Explain the working principle of centrifugal pump. **(08 Marks)**

c. What is cavitation? Briefly explain. **(04 Marks)**

Module-3

5 a. Give the broad classification of I.C. engines and with a neat sketch, explain the various parts of an I.C. engine. **(12 Marks)**

b. 4-stroke diesel engine has a Piston diameter of 250 mm, stroke length of 400 mm, mean effective pressure is 4 bar, dia of brake drum is 1m and speed is 500 rpm. Calculate the IP, BP and FP by assuming an effective brake load of 400 N. **(08 Marks)**

OR

6 a. List the important properties of a good refrigerant. **(04 Marks)**

b. Sketch and explain the working principle of vapour compression refrigeration system. **(10 Marks)**

c. Explain the working principle of air-conditioner. **(06 Marks)**

Module-4

7 a. Classify ferrous and non-ferrous materials and list the application of it. **(05 Marks)**

b. What is a composite material and classify the various composite materials? **(05 Marks)**

c. Explain TIG and MIG welding. **(10 Marks)**

OR

8	a.	Derive the expression for a length of a belt for a open belt drive.	**(10 Marks)**
	b.	List the advantages of gear drives over belt drives.	**(04 Marks)**
	c.	A gear wheel of 20 teeth drives another gear having 36 teeth running at 200 rpm. Calculate the speed of driving wheel and velocity ratio.	**(06 Marks)**

Module-5

9	a.	Explain any three lathe operations with simple sketch.	**(06 Marks)**
	b.	Sketch and explain taper turning by Tailstock offset method.	**(06 Marks)**
	c.	Explain the construction and working of vertical milling machine.	**(08 Marks)**

OR

10	a.	Sketch and explain the components of a CNC machine.	**(08 Marks)**
	b.	List the advantages of CNC machines over conventional machines.	**(04 Marks)**
	c.	List and explain any one type of robot configuration system.	**(08 Marks)**

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CBCS SCHEME

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

18MAT31

Third Semester B.E. Degree Examination, July/August 2022
Transform Calculus, Fourier Series and 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,
(i) $e^{-2t}(2\cos 5t - \sin 5t)$ (ii) $\cosh^2 3t$ **(06 Marks)**

b. Find the Laplace transform of the full wave rectifier $f(t) = E\sin\omega t \quad 0 < t < \frac{\pi}{\omega}$ having a period $\frac{\pi}{\omega}$. **(07 Marks)**

c. Find the inverse Laplace transform $\left[\frac{s^2+4}{s(s+4)(s-4)}\right]$. **(07 Marks)**

OR

2 a. Find the Laplace transform, $\frac{\cos at - \cos bt}{t}$. **(06 Marks)**

b. Solve by using Laplace transform method $y'''(t) + 2y''(t) - y'(t) - 2y(t) = 0$, given $y(0) = y'(0) = 0$ and $y''(0) = 6$ **(07 Marks)**

c. Express the function f(t) in terms of unit step function and hence find its inverse LT,

$$f(t) = \begin{cases} \cos t & 0 < t \le \pi \\ 1 & \pi < t \le 2\pi \\ \sin t & t > 2\pi \end{cases}$$ **(07 Marks)**

Module-2

3 a. Obtain the Fourier series of $f(x) = \frac{\pi - x}{2}$, in $0 < x < 2\pi$. Hence deduce that $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + ... = \frac{\pi}{4}$. **(06 Marks)**

b. Show that the sine half range series for the function, $f(x) = Lx - x^2$, in $0 < x < L$ is $\frac{8L^2}{\pi^3}\sum_0^\infty \frac{1}{(2n+1)^3}\sin\left(\frac{2n+1}{L}\right)\pi x$. **(07 Marks)**

c. Obtain the Fourier series of y up to the first harmonics for the following values :

x°	45	90	135	180	225	270	315	360
y	4.0	3.8	2.4	2.0	−1.5	0	2.6	3.4

(07 Marks)

OR

4 a. Expand the function $f(x) = x\sin x$, as a Fourier series in the interval $-\pi \le x \le \pi$. Deduce that $\frac{1}{1,3} - \frac{1}{3,5} + \frac{1}{5,7} ..... = \frac{\pi - 2}{4}$ **(06 Marks)**

b. Obtain the half range cosine series of $f(x) = x\sin x \quad 0 \le x \le \pi$. **(07 Marks)**

c. Obtain the constant term and the first three coefficients in the Fourier cosine series for y using the following data :

x	0	1	2	3	4	5
y	4	8	15	7	6	2

(07 Marks)

Module-3

5 a. Find the complex Fourier transform of the function, $f(x) = \begin{cases} 1 & \text{for } |x| \le a \\ 0 & \text{for } |x| > a \end{cases}$.

Hence evaluate $\int_0^\infty \frac{\sin x}{x} dx$. **(06 Marks)**

b. If $\overline{f(z)} = \frac{2z^2 + 3z + 12}{(z-1)^4}$ find the value of u_0, u_1, u_2, u_3 **(07 Marks)**

c. Solve by using z-transforms, $u_{n+2} + 5u_{n+1} + 6u_n = 2^n : u_1 = 0, u_0 = 0$ **(07 Marks)**

OR

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

b. Find the Fourier sine and cosine transform of $2e^{-3x} + 3e^{-2x}$. **(07 Marks)**

c. Solve by using Z-transforms,
$y_{n+2} + 2y_{n+1} + y_n = n$, with $y(0) = 0 = y$ **(07 Marks)**

Module-4

7 a. Use Taylor's series method to find y(4.1) given that $\frac{dy}{dx} = \frac{1}{x^2 + y}$ and $y(4) = 4$. **(06 Marks)**

b. Use Fourth order Runge-Kutta method to solve $(x+y)\frac{dy}{dx} = 1$, $y(0.4) = 1$ at $x = 0.5$. Correct to four decimal places. **(07 Marks)**

c. The following table gives the solution of $5xy^1 + y^2 - 2 = 0$, find the value of y at x = 4.5 using Milne's Predictor and Corrector formulae, use the corrector formulae twice.

x	4	4.1	4.2	4.3	4.4
y	1	1.0049	1.0097	1.0143	1.0187

(07 Marks)

OR

8 a. Using modified Euler's method find y at x = 0.2 given $\frac{dy}{dx} = 3x + \frac{y}{2}$, with $y(0) = 1$ taking h = 0.1. **(06 Marks)**

b. Using Runge-Kutta method of fourth order find y(0.2) for the equation $\frac{dy}{dx} = \frac{y - x}{y + x}$, y(0) = 1 taking h = 0.2 **(07 Marks)**

c. Apply Adams-Bashforth method to solve the equation $(y^2 + 1)dy - x^2 dx = 0$, at x = 1, given y(0) = 1, y(0.25) = 1.0026, y(0.5) = 1.0206, y(0.75) = 1.0679. Apply the corrector formulae twice. **(07 Marks)**

Module-5

9 a. Given $\frac{d^2y}{dx^2} - x^2\frac{dy}{dx} - 2xy = 1$, $y(0) = 1$, $y'(0) = 0$, Evaluate $y(0.1)$ using Runge-Kutta method of order 4. **(06 Marks)**

b. A necessary condition for the integral $I = \int_{x_1}^{x_2} f(x, y, y')dx$ where $y(x_1) = y_1$ and $y(x_2) = y_2$ to be extremum that $\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$. **(07 Marks)**

c. Show that the extremal of the functional $\int_0^1 y^2\{3x(y'^2 - 1) + yy'^3\}dx$, subject to the conditions $y(0) = 0$, $y(1) = 2$, is the circle $x^2 + y^2 - 5x = 0$. **(07 Marks)**

OR

10 a. Apply Milne's method to compute $y(0.8)$. Given that $\frac{d^2y}{dx^2} = 1 - 2y\frac{dy}{dx}$ and the following table of initial values. **(06 Marks)**

x	0	0.2	0.4	0.6
y	0	0.02	0.0795	0.1762
y′	0	0.1996	0.3937	0.5689

b. Find the extremal of the functional $\int_a^b (x^2y'^2 + 2y^2 + 2xy)dx$. **(07 Marks)**

c. Prove that Geodesics on a plane are straight line. **(07 Marks)**

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CBCS SCHEME

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18ME32

Third Semester B.E. Degree Examination, July/August 2022
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 :
i) True stress ii) Resilience iii) Ductility iv) Toughness. **(04 Marks)**

b. Derive the expression for the extension of uniformly tapering circular rod subjected to axial load. **(08 Marks)**

c. A steel bar ABCD 4mt long subjected to forces as shown in Fig. Q1(c). Find the elongation of bar. Take E for the steel as 200 GPa. **(08 Marks)**

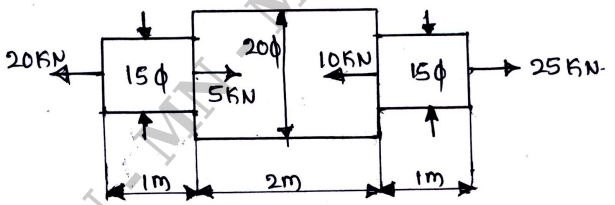

Fig. Q1(c)

OR

2 a. Define the following : i) Poisson's Ratio ii) Young's Modulus
iii) Modulus of Rigidity iv) Bulk modulus. **(04 Marks)**

b. A bar of 20mm diameter is tested in tension. It is observed that when a load of 37.7 KN 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 constant E, G and K. **(08 Marks)**

c. A composite bar is rigidly fitted at the supports A and B as shown in Fig. Q2(c). Determine the reactions at the supports when the temperature rises by 20°C. Take E_a = 70 GN/m^2 , E_s = 200GN/m^2 , $\alpha_a = 11 \times 10^{-6}$/°C and $\alpha_s = 12 \times 10^{-6}$/°C. **(08 Marks)**

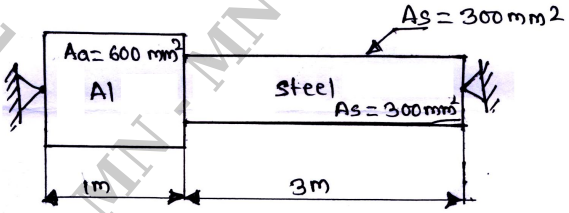

Fig. Q2(c)

Module-2

3 The state of stress in a two dimensionally stressed body is as shown in Fig. Q3. Determine the Principal planes , Principal stress , Maximum shear stress and their planes Analytically and Validate answer by graphically (using Mohr's circle). **(20 Marks)**

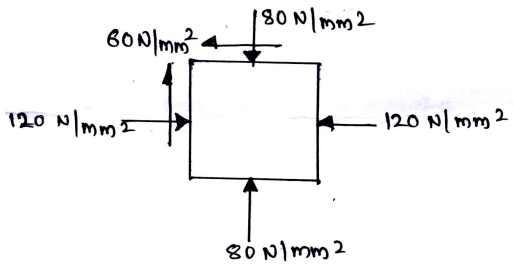

Fig. Q3

OR

4 a. Derive the expression for circumferential and radial stresses in the wall of thick cylinder [Lame's equation] with assumptions made. **(10 Marks)**

b. A thin cylindrical vessel made of steel plates 4mm thick with plane ends, carries fluid under pressure of $3N/mm^2$. The diameter of cylinder is 25cms and the length is 75cms. Calculate the longitudinal and hoop stresses in the cylinder wall and determine the change in diameter, length and volume of the cylinder. Take $E = 2.1 \times 10^5$ N/mm^2 and $1/m = 0.286$. **(10 Marks)**

Module-3

5 a. Explain different types of loads in beams. **(04 Marks)**

b. For the beam as shown in Fig. Q4(b). Determine the magnitude of load 'P' acting at point C, such that the reactions at supports A & B are equal. Draw shear force and bending moment diagram for the beam. Mark the silent points and their values on the diagram. Locate the point of contra flexure if any. **(16 Marks)**

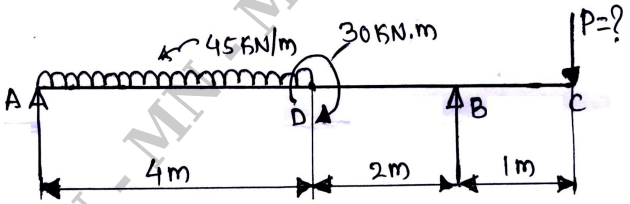

Fig. Q4(b)

OR

6 a. Derive the relation $\frac{M}{I} = \frac{\sigma b}{Y} = \frac{E}{R}$ with usual notations and list the basic assumptions. **(10 Marks)**

b. A rolled steel joint of I – Section used as simply supported beam has the following dimensions : Flange (250×25)mm , Web – 15mm thick , Overall depth – 50mm. If this beam carries a UDL of 50kN/m on a span of 4m, calculate the maximum stress produced due to bending. **(10 Marks)**

Module-4

7 a. Explain i) Maximum principal stress theory ii) Maximum shear stress theory. **(10 Marks)**

b. A shaft is required to transmic 245 KW power at 240 rpm. The maximum torque may be 1.5 times the mean torque. The shear stress in the shaft should not exceed $40N/mm^2$ and the twist 1° per meter length. Determine the diameter required, if i) the shaft is solid
ii) the shaft is hollow with external diameter twice the internal diameter.
Take modulus of rigidity = $80KN/mm^2$. **(10 Marks)**

OR

8 a. List all assumptions and derive the torsional formula in standard form
$\frac{T}{J} = \frac{\tau}{R} = \frac{G\theta}{L}$. **(10 Marks)**

b. In a plate of C45 steel (σ_{yt} = 353 Mpa) subjected to a system of loads, following stresses are induced at critical point : $\sigma_x = 150$ N/mm^2 , $\sigma_y = 100N/mm^2$ and $\tau_{xy} = 50N/mm^2$. Check wheather there is failure according to i) Maximum Principal Stress theory.
ii) Maximum shear stress theory. If the material is safe, find the factor of safety as per both theories. **(10 Marks)**

Module-5

9 a. Derive the expression for strain energy due to shear. **(07 Marks)**

b. Define : i) Strain energy ii) Resilience iii) Proof Resilience iv) Modulus of Resilience. **(04 Marks)**

c. A 2m long pin ended column of square cross section is to be made up of wood. Assuming E = 12GPa and allowable stress being limited to 12MPa. Determine the size of the column to support the following load safety. i) 95 KN ii) 200 KN. Use factor of safety of 3 and Euler's crippling loads for buckling. **(09 Marks)**

OR

10 a. Derive an expression for critical load in a column subjected to compressive load, when one end is fixed and other end is free. **(10 Marks)**

b. Derive the expression for strain energy due to impact load for axial load applications. **(10 Marks)**

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CBCS SCHEME

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18ME33

Third Semester B.E. Degree Examination, July/August 2022
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. Define Thermodynamic system, differentiate between open, closed and isolated system. **(08 Marks)**

b. Explain the following: i) State ii) Process iii) Cyclic process. **(06 Marks)**

c. A temperature scale of a certain thermometer is given by the relation t = a *l*n p + b, where a and b are constants and p is Thermometric property. If at ice point and steam point the properties are found to be 2.5 and 9.5 respectively, what will be the temperature corresponding to the thermometric property of 4.5 on Celsius scale. **(06 Marks)**

OR

2 a. Explain briefly Zeroth law of Thermo dynamics. **(06 Marks)**

b. Explain the following:
i) Quasistatic process
ii) Adiabatic and dia thermal wall
iii) Reversible process. **(06 Marks)**

c. Estimate the % variation in temperature from a thermocouple from a thermocouple having its test junction in gas and other reference junction at ice point. The temperature of gas using gas thermometer is found to be 50°C. Thermocouple is calibrated with emf varying linearly between ice point and steam point. When thermocouple's test junction is kept in gas t°C and reference junction at ice point, the emf produced in millivolts is $e = 0.18t - 5.2 \times 10^{-4}t^2$. **(08 Marks)**

Module-2

3 a. Compare heat and work. **(06 Marks)**

b. Derive an expression for work in a polytropic process. **(06 Marks)**

c. A fluid at a pressure of 3 bar, and with specific volume of $0.18 m^3/kg$ contained in a cylinder behind a piston expands reversibly to a pressure of 0.6bar, according to a Law $P = \frac{c}{v^2}$ where c is a constant. Calculate the workdone by the fluid on the piston. Show the process on p-v diagram. **(08 Marks)**

OR

4 a. State first law of thermodynamics and show that internal energy is property of a system. **(08 Marks)**

b. What do you mean by "Perpetual Motion Machine of first kind, PMM-1"? **(04 Marks)**

c. A stream of gases at 7.5 bar, 750°C and 140m/s is passed through a turbine of a jet engine. The gases comes out of the turbine at 2 bar, 550°C and 280m/s. The process may be assumed adiabatic. The enthalpies of gas at the entry and exit of the turbine are 950kJ/kg and 650kJ/kg of gas respectively. Determine the capacity of the turbine in KW if the gas flow rate is 5kg/s. **(08 Marks)**

Module-3

5 a. Give the following statements of second law of thermodynamics:
i) Clausius statement ii) Kelvin Plank statement. **(06 Marks)**

b. Show that the efficiency of a Reversible heat engine is more than a Irreversible heat engine, both heat engines working between the same temperature limits. **(06 Marks)**

c. A heat pump working on a reversed carnot cycle takes in energy from a reservoir, maintained at 5°C and delivers it to another reservoir where temperature is 77°C. The heat pump derives power for its operation from a reversible engine operating with in the higher and lower temperature of 1077°C and 77°C. For 100kJ/kg of energy supplied to reservoir at 77°C, estimate the energy taken from the reservoir at 1077°C. **(08 Marks)**

OR

6 a. State and prove Clausius Inequality. **(08 Marks)**

b. Prove that entropy is a property of a system. **(06 Marks)**

c. In an air turbine the air expands from 7 bar 460°C to 1.012 bar and 160°C. The heat loss from the turbine can be assumed to be negligible. Estimate the change in entropy. **(06 Marks)**

Module-4

7 a. Explain the concept of available and unavailable energy. When does the system becomes dead? **(06 Marks)**

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

c. A heat engine is working between 700°C and 30°C. The temperature of surroundings is 17°C. Engine receives heat at the rate of 2×10^4kJ/min and the measured output of engine is 0.13MW. Determine the availability, rate of irreversibility and second law efficiency of engine. **(08 Marks)**

OR

8 a. Define the following: i) Triple point ii) Critical point iii) Enthalpy of wet steam iv) Dryness fraction. **(08 Marks)**

b. Draw a neat sketch of throttling calorimeter and explain how dryness fraction is determined. **(06 Marks)**

c. A throttling calorimeter is attached to the steam pipe carrying steam at 11 bar. The pressure and temperature of steam after throttling are 1.2 bar and 120°C. Find the dryness fraction of steam. Take $C_P = 2.1$ for super heated steam. What is the maximum dryness fraction that can be measured under above condition? **(06 Marks)**

Module-5

9 a. Define the terms partial pressure, massfraction and mole fraction. **(06 Marks)**

b. Develop an expression to determine the gas constant and molecular weight of a mixture of ideal gases. **(06 Marks)**

c. A mixture of gases has the following volumetric composition.
$CO_2 = 12\%$, $O_2 = 4\%$, $N_2 = 82\%$, $CO = 2\%$.
Calculate: i) The gravimetric composition ii) Molecular weight of mixture iii) R for mixture. **(08 Marks)**

OR

10 a. Explain the following: i) Compressibility factor ii) Reduced properties iii) Law of corresponding states. **(06 Marks)**

b. Write a note on compressibility chart. **(06 Marks)**

c. Determine the pressure of Nitrogen in a steel vessel having a volume of 15 litres and containing 3.4kg at 400°C by using i) Ideal gas equation ii) Vander Walls equation. **(08 Marks)**

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18ME35B/MEB305

Third Semester B.E. Degree Examination, July/August 2022
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 manufacturing process. Classify manufacturing process. **(08 Marks)**
b. Define pattern and give its classification. **(06 Marks)**
c. What are pattern allowances? **(06 Marks)**

OR

2 a. Explain the different properties of moulding sand. **(08 Marks)**
b. Explain:
i) CO_2 moulding
ii) Shell moulding. **(12 Marks)**

Module-2

3 a. Explain:
i) Electric-arc Furnace
ii) Resistance Furnace. **(10 Marks)**
b. Explain construction and operation of cupola. **(10 Marks)**

OR

4 Explain:
a. Gravity Die casting
b. Centrifugal casting
c. Thixocasting process
d. Squeeze casting. **(20 Marks)**

Module-3

5 a. Why is directional solidification essential in casting? Explain with sketches. **(12 Marks)**
b. State the advantages and limitations of casting process. **(08 Marks)**

OR

6 a. List the casting defects. Explain the causes and remedial measures. **(10 Marks)**
b. Explain stir casting for melting of aluminium. **(10 Marks)**

Module-4

7 a. Define Welding. Classify it. List out the advantages, limitations of welding process. **(10 Marks)**
b. Differentiate between TIG and MIG welding with neat sketches. **(10 Marks)**

OR

8 a. Explain how an arc is generated in arc welding. With neat sketch, explain flux shielded metal arc welding. **(10 Marks)**

b. Explain laser welding and electron beam welding with neat sketches. **(10 Marks)**

Module-5

9 a. Discuss formation of different zones during welding process. **(10 Marks)**

b. Explain ultrasonic welding with neat sketch. List advantages and disadvantages. **(10 Marks)**

OR

10 a. Differentiate between soldering and brazing. **(08 Marks)**

b. Explain Fluorescent particle inspection with neat sketch. **(08 Marks)**

c. With neat sketches, explain any four welding defects. **(04 Marks)**

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CBCS SCHEME

USN | | | | | | | | | | **18MAT41**

Fourth Semester B.E. Degree Examination, July/August 2022
Complex Analysis, Probability and Statistical Methods

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Derive Cauchy-Riemann equation in Polar form. **(06 Marks)**

b. Find the analytic function f(z) whose real part is
$x \sin x \cosh y - y \cos x \sinh y$ **(07 Marks)**

c. If f(z) is analytic show that
$$\left[\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}\right]|f(z)|^2 = 4|f'(z)|^2$$ **(07 Marks)**

OR

2 a. Find the analytic function f(z) given that the sum of its real and imaginary part is
$x^3 - y^3 + 3xy(x - y)$ **(06 Marks)**

b. Find the analytic function f(z) = u + iv if
$v = r^2 \cos 2\theta - r \cos\theta + 2$ **(07 Marks)**

c. If f(z) is analytic function then show that
$$\left\{\frac{\partial}{\partial x}|f(z)|\right\}^2+\left\{\frac{\partial}{\partial y}|f(z)|\right\}^2 = |f'(z)|^2$$ **(07 Marks)**

Module-2

3 a. State and prove Cauchy's Integral formula. **(06 Marks)**

b. Evaluate $\int_0^{2+i} \bar{z}^2 dz$ along (i) the line $y = \frac{x}{2}$ (ii) The real axis to 2 and then vertically to 2 + i. **(07 Marks)**

c. Find the bilinear transformation which maps the points 1, i, –1 onto the points i, 0, –i respectively. **(07 Marks)**

OR

4 a. Discuss the transformation $w = e^z$, with respect to straight lines parallel to x and y axis. **(06 Marks)**

b. Using Cauchy's integral formula evaluate
$$\int_c \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)(z-2)} dz$$, where c : |z| = 3 **(07 Marks)**

c. Find the bilinear transformation which maps the points 0, 1, ∞ on to the points –5, –1, 3 respectively. **(07 Marks)**

Module-3

5 a. A random variable X has the following probability function for various values of X.

X	0	1	2	3	4	5	6	7
P(X)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2+k$

Find i) k ii) P(X < 6) iii) P(3 < X ≤ 6) **(06 Marks)**

b. Out of 800 families with 5 children each, how many families would you expect to have (i) 3 boys (ii) 5 girls (iii) either 2 or 3 boys (iv) atmost 2 girls, assuming equal probabilities for boys and girls. **(07 Marks)**

c. The length in time (minutes) that a certain lady speaks on a telephone is a random variable with probability density function

$$f(x) = \begin{cases} Ae^{-x/5} & \text{for } x > 0 \\ 0 & \text{elsewhere} \end{cases}$$

Find the value of the constant A. What is the probability that she will speak over the phone for (i) More than 10 minutes (ii) Less than 5 minutes (iii) Between 5 and 10 minutes. **(07 Marks)**

OR

6 a. Find the constant C such that the function

$$f(x) = \begin{cases} Cx^2, & 0 < x < 3 \\ 0 & \text{otherwise} \end{cases}$$ is a probability density function. Also compute $P(1 < x < 2)$, $P(x \le 1)$ and $P(x > 1)$ **(06 Marks)**

b. 2% fuses manufactured by a firm are found to be defective. Find the probability that the box containing 200 fuses contains
(i) No defective fuses (ii) 3 or more defective fuses (iii) At least one defective fuse. **(07 Marks)**

c. If x is a normal variate with mean 30 and standard deviation 5 find the probabilities that (i) $26 \le x \le 40$ (ii) $x \ge 45$ (iii) $|x - 30| > 5$
Given that $\phi(1) = 0.3413$, $\phi(0.8) = 0.2881$, $\phi(2) = 0.4772$, $\phi(3) = 0.4987$ **(07 Marks)**

Module-4

7 a. The following table gives the ages (in years) of 10 married couples. Calculate Karl Pearson's coefficient of correlation between their ages:

Age of husband (x)	23	27	28	29	30	31	33	35	36	39
Age of wife (y)	18	22	23	24	25	26	28	29	30	32

(06 Marks)

b. In a partially destroyed laboratory record of correlation data only the following results are available:
Variance of x is 9 and regression lines are $8x - 10y + 66 = 0$, $40x - 18y = 214$. Find
(i) Mean value of x and y
(ii) Standard deviation of y
(iii) Coefficient of correlation between x and y. **(07 Marks)**

c. Fit a parabola of the form $y = ax^2 + bx + c$ for the data

x	0	1	2	3	4
y	1	1.8	1.3	2.5	6.3

(07 Marks)

OR

8 a. Obtain the lines of regression and hence find the coefficient of correlation of the data:

x	1	3	4	2	5	8	9	10	13	15
y	8	6	10	8	12	16	16	10	32	32

(06 Marks)

b. Show that if θ is the angle between the lines of regression

$$\tan\theta = \frac{\sigma_x \sigma_y}{\sigma_x^2 + \sigma_y^2}\left(\frac{1 - r^2}{r}\right)$$ **(07 Marks)**

c. Fit a straight line y = a + bx to the data

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

(07 Marks)

Module-5

9 a. The joint probability distribution of the random variables X and Y is given below.

X \ Y	-4	2	7
1	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$
5	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{8}$

Find (i) E[X] and E[Y] (ii) E[XY] (iii) cov(X, Y) iv) ρ(X, Y).
Also, show that X and Y are not independent. **(06 Marks)**

b. A manufacturer claimed that atleast 95% of the equipment which he supplied to a factory confirmed to specifications. An examination of a sample of 200 pieces of equipment revealed that 18 of them were faulty. Test his claim at a significance level of 1% and 5% ($z_{0.05} = 1.96$, $z_{0.01} = 2.58$). **(07 Marks)**

c. A certain stimulus administered to each of the 12 patients resulted in the following change in blood pressure 5, 2, 8, –1, 3, 0, 6, –2, 1, 5, 0, 4. Can it be concluded that the stimulus will increase the blood pressure ($t_{0.05}$ for 11 d.f. is 2.201) **(07 Marks)**

OR

10 a. Define the terms :
(i) Null hypothesis (ii) Type-I and Type – II errors (iii) Significance level **(06 Marks)**

b. In an experiment of pea breeding the following frequencies of seeds were obtained:

Round Yellow	Wrinkled Yellow	Round Green	Wrinkled Green	Total
315	101	108	32	556

Theory predicts that the frequencies should be in proportions 9:3:3:1
Is the experiment in agreement with theory ($\chi^2_{0.5}$ for 3 d.f is 7.815) **(07 Marks)**

c. The joint probability distribution of two discrete random variable X and Y is given by f(x, y) = k(2x + y) where x and y are integers such that $0 \le x \le 2$, $0 \le y \le 3$. Find k and the marginal probability distribution of X and Y. Show that the random variables X and Y are dependent. Also, find $P(X \ge 1, Y \le 2)$. **(07 Marks)**

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CBCS SCHEME

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

18ME42

Fourth Semester B.E. Degree Examination, July/August 2022
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 Thermodynamics data hand book is permitted.***

Module-1

1 a. Derive an expression of air standard efficiency of diesel cycle with neat PV and T-S diagrams. **(10 Marks)**

b. An engine with 200mm cylinder diameter and 300mm Stroke length works on diesel cycle. The initial pressure and temperature of air are 0.1 MPa and 27ºC. The cutoff is 8% of Stroke volume and compression ratio is 15. Determine :
i) Pressure and temperature at all salient points ii) Air standard efficiency. **(10 Marks)**

OR

2 a. Explain any two methods of deeming frictional power. **(08 Marks)**

b. The following observations were made during one hour test on a single Stroke oil engine.
Bore = 300mm ; Stroke = 450mm ; mass of fuel used = 8.8Kg ;
Calorific value = 41800kJ/Kg ;
Average speed = 200rpm, Mean effective pressure = 5.8 bar, Brake load = 1860N, Mass of cooling water = 650Kg, Temperature rise = 22ºC, Diameter of Brake drum = 1.22 m.
Calculate: i) Mechanical efficiency ii) Brake thermal efficiency iii) Draw heat balance sheet on kJ/hr basis. **(12 Marks)**

Module-2

3 a. Derive an expression of optimum pressure ratio for maximum workout put in case of actual Brayton cycle. **(10 Marks)**

b. Air enters the compressor of a gas turbine plant operating on Brayton cycle at 101.325KPa, 27ºC. The pressure ratio in the cycle is 6. Calculate the maximum temperature in the cycle and cycle efficiency. Assume $W_T = 2.5W_c$. Where W_T and W_C are the turbine and compressor work respectively. Take r = 1.4. **(10 Marks)**

OR

4 a. With a neat block diagram and T-S diagram, explain how 'regeneration' increases thermal efficiency of gas turbine plant. **(08 Marks)**

b. Air is drawn in a gas turbine unit at 15ºC and 1.01bar and pressure ratio is 7. The compressor is driven by the high pressure turbine and low pressure turbine drives a separate shaft. The isentropic efficiencies of compressor and HP and LP turbines are 0.82, 085 and 0.85 respectively. If the maximum cycle temperature is 610ºC, find :
i) The pressure and temperature of the gases entering the power turbine
ii) The net power developed by the unit per Kg/sec mass flow.
iii) Work ratio
iv) Thermal efficiency of the unit
Neglect the mass of the fuel and assume the following :
For compression process, $C_{Pa} = 1.005$ kJ/Kg.K and r = 1.4.
For combustion and expansion process : $C_{pg} = 1.15$ kJ/Kg.K and r = 1.33. **(12 Marks)**

Module-3

5 a. Discuss the effect of i) Boiler pressure ii) Condenser pressure iii) Super heat on the performance of a Rankine cycle. **(10 Marks)**

b. Steam at 1 bar and 350ºC is expanded in a steam turbine to 0.08bar. It them enters the condenser, where it is condensed to saturated liquid water. Assume the turbine and feed pump efficiencies as 80% and 90% respectively. Determine per Kg of steam the network, the heat transferred to the working fluid and Rankine efficiency. **(10 Marks)**

OR

6 a. Sketch and explain the flow diagram and corresponding T-S diagram of practical regenerative Rankine cycle. **(10 Marks)**

b. A reheat cycle has the first stage supply conditions of 70bar and 500ºC. The reheat is at 3 bar and to the same temperature.

i) Given that the efficiency of the first stage turbine is 80%, how much energy is added per kg of steam in the reheat coils?

ii) Assume that the same expansion efficiency exists in the second turbine. What is the thermal efficiency, if the condenser pressure is 0.03 bars? **(10 Marks)**

Module-4

7 a. Explain the effect of super heating and under cooling the refrigerant on the performance of vapour compression refrigeration cycle. **(06 Marks)**

b. What are the properties of refrigerants? **(04 Marks)**

c. A vapour compression refrigerator uses methyl Chloride (R – 40) and operates between the temperature limits of -10ºC and 45ºC. At the entry to the compressor the refrigerant is dry saturated and after the compression it acquires a temperature of 60ºC. Find COP of the refrigerator. The relevant properties of R – 40 are as follows :

Saturation temperature	Enthalpy		Entropy	
	Liquid	Vapour	Liquid	Vapour
-10ºC	45.4	460.7	0.183	1.637
45ºC	133	483.6	0.485	1.587

Also find mass of methyl chloride and power required for a capacity of 15 TOR. **(10 Marks)**

OR

8 a. Define : i) Wet bulb temperature ii) Dew point temperature iii) Relative humidity iv) Specific humidity v) Degree of saturation. **(10 Marks)**

b. Air is to be conditioned from 40º C (DBT) and 50% RH to a final temperature of 20ºC (DBT) and 40% RH, by de-humidification process, followed by a reheat process. Assuming that the entire process is at constant pressure of 101.325 KPa, determine :

i) The amount of water to be removed from air

ii) The temperature of air leaving the dehumidifier

iii) Refrigeration in tons for air flow rate of 0.47m^3/sec

iv) Heating required in kW. **(10 Marks)**

Module-5

9 a. Derive an expression for minimum work input by two stage compressor with intercooler. **(10 Marks)**

b. A single stage single acting reciprocating air compressor has a bore of 200mm and Stroke of 300mm. It receives air at 1 bar and 20ºC and delivers it at 5.5 bar. If the compression follows the law $PV^{1.3} = C$ and clearance volume is 5% of the Stroke volume, determine :

i) Mean effective pressure

ii) Power required to drive the compressor if it runs at 500rpm. **(10 Marks)**

OR

10 a. Derive an expression of critical pressure ratio which gives maximum discharge through the nozzle. **(10 Marks)**

b. Steam at 15bar and 250ºC is expanded in a nozzle to 1 bar. For a discharge of 0.5kg/sec find throat and exit diameter for maximum discharge conditions. Assume the nozzle efficiency as 90%. **(10 Marks)**

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CBCS SCHEME

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

18ME43

Fourth Semester B.E. Degree Examination, July/August 2022
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 and write the equations for the following properties of fluid:
(i) Specific weight (ii) Specific gravity (iii) Mass density
(iv) Dynamic viscosity (v) Kinematic viscosity **(10 Marks)**

b. Calculate the dynamic viscosity of an oil, which is used for lubrication between a square plate of size 0.8m × 0.8m and an inclined plane with angle of inclination 30° as shown in Fig.Q1(b). The weight of the square plate is 300 N and it slides down the inclined plane with a uniform velocity of 0.3 m/s. The thickness of oil film is 1.5 mm.

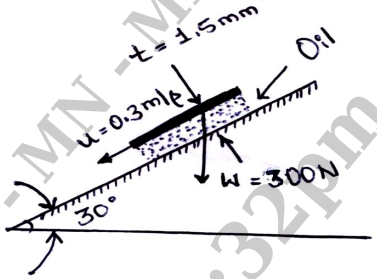

Fig.Q1(b) **(10 Marks)**

OR

2 a. Derive an equation for total pressure force and position of center of pressure for a plane surface submerged in static fluid making an angle with the free surface of fluid. **(10 Marks)**

b. Find the total pressure and position of center of pressure on a triangular plate of base 2m and height 3m which is immersed in water in such a way that plane of the plate makes an angle of 60° with free surface of water. The base of plate is parallel to water surface and at a depth of 2.5 m from water surface. **(10 Marks)**

Module-2

3 a. Define Buoyancy, center of buoyancy and metacenter. Derive an equation for metacentric height of a floating body. **(10 Marks)**

b. A solid cone floats in water with its apex downwards. Determine the least apex angle of cone for stable equilibrium. The specific gravity of material of cone is 0.8. **(10 Marks)**

OR

4 a. Define the following types of fluid flow:
(i) Steady and unsteady flows (ii) Laminar and Turbulent flows
(iii) Uniform and nonuniform flows (iv) Rotational and irrotational flows
(v) Compressible and incompressible flows **(05 Marks)**

b. Define rate of flow and explain the principle of continuity equation. **(05 Marks)**

c. A jet of water from a 25 mm diameter nozzle is directed vertically upwards. Assuming that jet remains circular and neglecting any loss of energy that will be the diameter at a point 4.5 m above nozzle, if the velocity of the jet leaves the nozzle is 12 m/s. **(10 Marks)**

Module-3

5 a. Derive Euler's equation of motion along a stream line and state and deduce Bernoulli's equation for fluid flow, mention its assumptions. **(10 Marks)**

b. Utilizing Bernoulli's principles, derive equations for discharge of fluid through the pipe using the following devices: (i) Venturimeter (ii) Orificemeter **(10 Marks)**

OR

6 a. Derive Darcy-Weisbach equation for loss of heat due to friction in pipe. **(04 Marks)**

b. A horizontal pipeline 40 m long is connected to tank at one end and discharges freely into atmosphere at other end for the first 25 m of its length from tank. The pipe is 150 mm diameter and its diameter is suddenly enlarged to 300 mm. The height of water level in tank is 8m above the center of pipe. Considering all losses of head, determine the rate of flow. Take f = 0.01 for both sections of pipe. **(06 Marks)**

c. Prove that the loss of pressure head for the viscous flow through a circular pipe is given by $h_f = 32\,\mu\,\bar{u}\,L/wd^2$, where $\bar{u}$ = average velocity, w = specific weight. **(10 Marks)**

Module-4

7 a. With a neat sketch, define the following :
(i) Laminar boundary layer (ii) Turbulent boundary (iii) Laminar sublayer
(iv) Boundary layer thickness (v) Displacement thickness **(10 Marks)**

b. The velocity profile for a laminar boundary layer flows is $u/U = 2(y/\delta) - (y/\delta)^2$. Find the thickness of boundary layer at the end of plate and drag force on one side of a plate 1m long and 0.8 m wide when placed in water flowing with a velocity of 150 mm/s. Calculate the value of coefficient of drag also. Take μ for water = 0.01 poise. **(10 Marks)**

OR

8 a. State and explain Buckingham's π theorem. **(08 Marks)**

b. Using Buckingham's π theorem, shown that discharge Q consumed by an oil ring is given by $Q = Nd^3\phi\left[\frac{\mu}{\rho N d^2}, \frac{\sigma}{\rho N^2 d^3}, \frac{\omega}{\rho N^2 d}\right]$ where , d is internal diameter of ring, N is rotational speed, ρ is density, μ is viscosity, σ is surface tension and ω is specific weight of oil. **(12 Marks)**

Module-5

9 a. Define: (i) Mach number (ii) Sub-sonic flow (iii) Sonic flow (iv) Supersonic flow **(08 Marks)**

b. Define isothermal and adiabatic process during expansion or compression of perfect gas. **(04 Marks)**

c. Derive an expression for velocity of sound wave in a fluid. **(08 Marks)**

OR

10 a. Calculate the Mach number at a point on a jet propelled aircraft, which is flying at 1100 km/h at sea level where air temperature is 20°C. Take k = 1.4 and R = 287 J/kgK. **(08 Marks)**

b. Derive an expression for stagnation temperature (Ts). **(04 Marks)**

c. Mention the necessity, applications and limitation of CFD. **(08 Marks)**

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CBCS SCHEME

USN | | | | | | | | | | 18ME44

Fourth Semester B.E. Degree Examination, July/August 2022
Kinematics of Machines

Time: 3 hrs. Max. Marks: 100

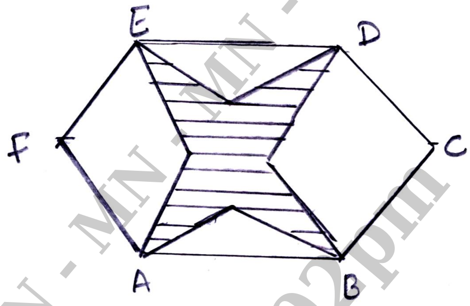
Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

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 :
   i) Kinematic chain.
   ii) Structure.
   iii) Machine.
   iv) Mechanism. **(08 Marks)**

b. Find the degrees of freedom for the following mechanism. **(04 Marks)**



c. What is Inversion? Explain any one Inversion of double slider crank mechanism with the help of a neat sketch. **(08 Marks)**

OR

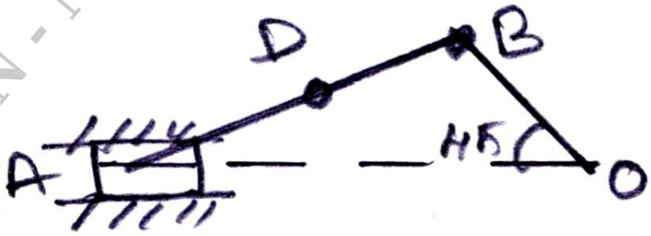
2 a. Explain the construction and working of Peaucillieri Mechanism with a neat sketch. Prove that it generates an exact straight line. **(08 Marks)**

b. What are the field applications and advantages of Quick return motion mechanism? Explain the crank and slotted lever mechanism using a neat sketch. **(12 Marks)**

Module-2

3 The crank of a slider crank mechanism rotates clockwise at a constant speed of 300 rpm. The crank is 150mm and connecting rod is 600mm. Determine
   i) Linear velocity and acceleration of the midpoint of the connecting rod and
   ii) Angular velocity and angular acceleration of the connecting rod, at a crank angle of 45° from the Inner dead centre position. **(20 Marks)**

Fig. Q3



OR

4 a. State and prove Arnold Kennedy theorem. **(06 Marks)**

b. Locate all the Instantaneous centres of the slider crank mechanism as shown in Fig. Q4(b). The lengths of crank OB and connecting rod AB are 100mm and 400mm respectively. If the crank rotates clockwise with an angular velocity of 10 rad/s. Find

i) Velocity of the slider A   ii) Angular velocity of the connecting rod AB. **(14 Marks)**

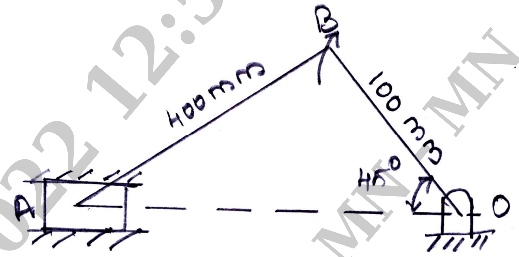


Fig. Q4(b)

Module-3

5 a. Derive analytical expressions for the determination of velocity and acceleration of Piston of a reciprocating engine. **(12 Marks)**

b. If the crank and connecting rod are 150mm and 600mm long respectively and the crank rotates at a constant speed of 100 rpm, determine the velocity and acceleration of Piston. The angle which the crank makes with the Inner dead centre is 30°. **(08 Marks)**

OR

6 a. Derive Freudensteins equation for slider bar Mechanism. **(10 Marks)**

b. Design a four bar mechanism to co-ordinate three positions of the Input and Output links as follows :

$\theta_1 = 20°$	$\phi_1 = 35°$
$\theta_2 = 35°$	$\phi_2 = 45°$
$\theta_3 = 50°$	$\phi_3 = 60°$

Using Freudenstein's equation for four bar mechanism. **(10 Marks)**

Module-4

7 a. State the different types of Cam's and follower and explain. **(04 Marks)**

b. A cam, with a minimum radius of 25mm rotating clockwise at a uniform speed is to be designed to give a roller follower, at the end of a valve rod, motion described below.

i) To raise the valve through 50mm during 120° rotation of the cam.
ii) To keep the valve fully raised through next 30°.
iii) To lower the valve during next 60° and
iv) To keep the valve closed during rest of the revolution is 150°.

The diameter of the roller is 20mm and the diameter of the cam shaft is 25mm. Draw the profile of a cam when the line of stroke is offset 15mm from the axis of the cam shaft. The displacement of the valve, while being raised and lowered, is to take place with SHM. **(16 Marks)**

OR

8 a. Define the following terms related to cam :

i) Base circle.
ii) Pressure angle.
iii) Cam profile.
iv) Lift. **(04 Marks)**

b. Design a cam for operating the exhaust valve of an oil engine. It is required to give equal uniform acceleration and retardation during opening and closing of the valve each of which corresponds to 60° of cam rotation. The valve must remain in the fully open position for 20° of cam rotation.
The lift of the valve is 37.5mm and the least radius of the cam is 40mm. The follower is provided with a roller of radius 20mm and its line of stroke passes through the axis of the cam. **(16 Marks)**

Module-5

9 a. Derive the expression for length of path of contact and arc of contact for a pair of involute gear's in contact. **(08 Marks)**

b. Two gear wheel mesh externally and are to give a velocity ratio of 3. The teeth are of involute form of module 6mm and standard addendum of one module. Pressure angle = 18°, Pinion rotates at 90 rpm.
Find i) Number of teeth on each wheel so that interference is just avoided.
ii) Length of path of contact iii) Length of arc of contact
iv) Maximum velocity of sliding between teeth v) Number of pairs of teeth in contact. **(12 Marks)**

OR

10 a. Explain with neat sketch : i) Simple gear Train ii) Compound gear Train
iii) Epicyclic gear Train. **(06 Marks)**

b. An epicyclic gear train consists of sun wheel (S), a stationary internal gear (E) and three identical planet wheels (P) carried on a star shaped planet carrier (C). The size of different toothed wheels are such that the planet carrier 'C' rotates at 1/5 of the speed of the sun wheel. The minimum number of teeth on any wheel is 6. 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. **(14 Marks)**

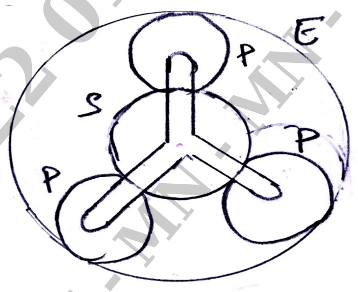


Fig. Q10(b)

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CBCS SCHEME

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18ME45A/18MEA405

Fourth Semester B.E. Degree Examination, July/August 2022
Metal Cutting & Forming

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Distinguish between orthogonal and oblique cutting with a neat sketch. **(06 Marks)**

b. List and explain different types of chips formed in metal cutting process and state the conditions for their formation. **(08 Marks)**

c. In an orthogonal cutting process, the following data was recorded, cutting speed : 120m/min, uncut chip thickness : 0.127mm, chip thickness : 0.228mm, Rake angle : 10º, width of cut : 6.35mm, cutting force : 567N and Thrust force : 227N. Calculate :
i) Shear angle ii) Friction angle iii) Power. **(06 Marks)**

OR

2 a. List and explain different types of cutting tool materials and state their specific applications. **(06 Marks)**

b. Sketch and explain the working principle of turret lathe. **(10 Marks)**

c. List and explain different types of lathe accessories. **(04 Marks)**

Module-2

3 a. Sketch and explain the principal parts of a vertical milling machine. **(10 Marks)**

b. What is indexing and explain compound indexing with an example. **(10 Marks)**

OR

4 a. Differentiate between drilling, boring and reaming operations. **(06 Marks)**

b. Give the comparisons between shaper and planer. **(04 Marks)**

c. Sketch and explain the working principle of centerless grinding process. **(10 Marks)**

Module-3

5 a. Sketch and explain different types of tool wear mechanisms. **(10 Marks)**

b. A tool life of 80 minutes is obtained for a cutting speed of 30m/min and 8 minutes for a speed of 60m/min. Determine the tool life equation and calculate the cutting speed for 4 minute tool life. **(06 Marks)**

c. List the important requirements of cutting fluids. **(04 Marks)**

OR

6 a. Derive the expression for optimum cutting speed for minimum cost in turning operation. **(10 Marks)**

b. In turning operation, it was observed that the tool life is 150min. While cutting at a speed of 20m/min. As the speed was increased to 25m/min and the tool life is reduced to 25.5min. If the time required to change the tool is 2 min and the cost of regrinding the tools is 10 times the cost of turning. Calculate the economic cutting speed and tool life for maximum production. **(10 Marks)**

Module-4

7	a.	Give the broad classification of metal forming processors.	**(04 Marks)**
	b.	Sketch and explain different types of forging hammers.	**(08 Marks)**
	c.	List and explain any two types of rolling mills.	**(08 Marks)**

OR

8	a.	Briefly explain rolling defects.	**(04 Marks)**
	b.	List and explain any one type of tube drawing process.	**(08 Marks)**
	c.	Sketch and explain any two types of extrusion process.	**(08 Marks)**

Module-5

9	a.	With a simple sketch, explain different types of sheet metal operations.	**(06 Marks)**
	b.	What is drawing process and explain the different factors to be considered in the design of drawing dies.	**(08 Marks)**
	c.	Find the total pressure, dimensions of tools to produce a washer of 55mm outer diameter and 25mm inner diameter having a thickness of 4mm, shear strength of 350N/mm^2.	**(06 Marks)**

OR

10	a.	Explain different types of dies used in forming process.	**(06 Marks)**
	b.	Sketch and explain progressive die used for producing a washer.	**(08 Marks)**
	c.	A cup without flanges and height of 100mm and diameter 50mm is to be made from sheet metal of 2.5mm thick. Find the suitable number of draws required to produce a cup by assuming 45%, 25% and 20% reduction.	**(06 Marks)**

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CBCS SCHEME

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18ME46B/18MEB406

Fourth Semester B.E. Degree Examination, July/August 2022
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. Explain international prototype meter with a neat sketch. **(06 Marks)**

b. Four length bars A, B, C and D each having a basic length 125 mm are to be calibrated using a calibrated length bar of 500 mm basic length. The 500 mm bar has an actual length of 499.9991 mm. Also, it was found that

$L_B = L_A + 0.0001$ mm

$L_C = L_A + 0.0005$ mm

$L_D = L_A - 0.0002$ mm

and $L_A + L_B + L_C + L_D = L + 0.0003$ mm

Determine L_A, L_B, L_C and L_D **(08 Marks)**

c. Define a standard. Write a note on wavelength standards. **(06 Marks)**

OR

2 a. Explain sine centre with a neat sketch. **(06 Marks)**

b. Explain the principle and construction of Auto collimator with a neat diagram. **(14 Marks)**

Module-2

3 a. Define the terms :

(i) Limits (ii) Fits (iii) Fundamental deviation (iv) Tolerance
(v) Allowance (vi) Basic size **(06 Marks)**

b. Determine the actual dimensions to be provided for a shaft and hole of 90 mm size for H_8C_9 type clearance fit. Given Diameter steps are 80 mm and 100 mm,

$i = 0.45\sqrt[3]{D} + 0.001D$,

Value of tolerances for IT8 = 25i and for IT9 = 40i

and Fundamental Deviation for 'C' type shaft $F.D = -11D^{0.41}$

and also design the GO and NOGO gauges, considering wear allowance. **(14 Marks)**

OR

4 a. Explain the construction and working of Sigma Comparator with a neat sketch. **(10 Marks)**

b. Explain Solex Pneumatic Comparator with a neat sketch. **(10 Marks)**

Module-3

5 a. Explain Toolmaker's microscope with a neat sketch. **(14 Marks)**

b. Define Best Size Wire. Derive an expression for the same. **(06 Marks)**

OR

6 a. Explain the measurement of gear tooth thickness using constant chord method. **(10 Marks)**

b. Explain the Gear tooth Vernier Caliper with a neat sketch. **(10 Marks)**

Module-4

7	a.	Explain Generalized measurement system with a Block Diagram.	**(12 Marks)**
	b.	Define : (i) Accuracy (ii) Precision (iii) Threshold (iv) Hysteresis	**(08 Marks)**

OR

8	a.	Define Transfer Efficiency. Explain Ionisation transducer with a neat sketch.	**(07 Marks)**
	b.	Classify Transducers. Explain Resistive transducers with a neat sketch.	**(13 Marks)**

Module-5

9	a.	Explain Equal arm balance for force measurement.	**(12 Marks)**
	b.	Explain Prony brake dynamometer with a neat sketch.	**(08 Marks)**

OR

10	a.	Explain Mc Leod gauge with a neat sketch.	**(10 Marks)**
	b.	Define thermocouple. State the laws of thermocouple and explain.	**(06 Marks)**
	c.	Explain the theory of strain gauges and define gauge factor.	**(04 Marks)**

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CBCS SCHEME

USN | | | | | | | | | | | **18ME51**

Fifth Semester B.E. Degree Examination, July/August 2022
Management and Economics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define Management. Explain Nature and characteristics of Management. **(08 Marks)**
b. Briefly explain the Early Management approaches and the Modern Management approaches. **(12 Marks)**

OR

2 a. Briefly explain the important steps in Planning. **(10 Marks)**
b. What are the types of Decision? Explain with example. **(10 Marks)**

Module-2

3 a. List and explain in brief the principles of Organisation. **(10 Marks)**
b. Briefly explain MBO and MBE with advantages and disadvantages. **(10 Marks)**

OR

4 a. Explain briefly Maslow's theory of Motivation. **(10 Marks)**
b. Explain the essentials of a Sound Control System. **(10 Marks)**

Module-3

5 a. With a neat sketch, explain the Problem solving process in Decision making. **(10 Marks)**
b. State and explain the Law of Demand and Supply. **(05 Marks)**
c. Determine the Effective Interest Rate for a Nominal Annual rate of 8% that is compounded :
i) Quarterly ii) Semi – annually. **(05 Marks)**

OR

6 a. Discuss the Interest rate from Lender's and borrower's Point of view. **(08 Marks)**
b. A Company 3 years ago borrowed Rs 4,00,000 to pay for a new machine , agreeing to repay the load in 100 monthly payments at an Annual Nominal Interest rate of 12% compounded monthly. The Company now wants to pay off the loan. How much would this payment be, assuming no penalty costs for early payout?
Interest factors : (A/P , 1% 100) = 0.01587 ; (P/A , 1% , 64) = 47.10277. **(12 Marks)**

Module-4

7 a. List and explain the conditions assumed for present worth comparisons. **(08 Marks)**
b. 5 Million rupees are donated to a college. 20 students are to be awarded scholarships over the next 20 years. The scholarships are each of Rs 12000/- per year, The first year and increase at a rate of Rs 1500 per year over the following 19 years. Starting with the end of third year, Rs 15000 are to be spent for maintenance of the college building. This costs rises linearly at the rate of Rs 2000 per year, starting with year 4. Assuming 10% interest rate, determine how much money will be available to construct on Auditorium now.
(A/G , 10% , 20) = 6.50808 (P/A , 10% , 20) = 8.51356
(A/G , 10% , 18) = 6.05256 (P/A , 10% , 18) = 8.20141
(P/F , 10% , 2) = 0.82645. **(12 Marks)**

OR

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

b. Briefly explain the following terms as applied to Asset life :
i) Service life ii) Accounting life iii) Economic life. **(06 Marks)**

c. A Company can purchase a new central computer for Rs 17500 or can lease it for 3 years with annual payments of Rs 8400. Determine at what interest rate the leasing and purchasing costs would be equivalent , if lease payments were due at the end of each year.
(P/A , 20% , 3) = 2.10648 ; (P/A , 25% , 3) = 1.95200. **(06 Marks)**

Module-5

9 a. Explain how selling price is determined for a product with a block diagram. **(07 Marks)**

b. Differentiate between Estimation and Costing. **(05 Marks)**

c. The catalogue price of a washing machine is Rs 9000 and the commission allowed to the proprietor of the show room is 20%. The administrative and the selling expenses are 60% of the factory cost and material cost, labour cost and factory overheads are in the ratio of 2:3:1. If the cost of the labour on the manufacturing of machine is Rs 1650, determine the profit on each washing machine. **(08 Marks)**

OR

10 a. What is Depreciation? What are the causes of Depreciation? **(06 Marks)**

b. List different methods of determining depreciation and explain any two of them. **(06 Marks)**

c. A car was purchased for 400,000 and salvage value was estimated as Rs 100,000 at the end of 8 year of useful life. Calculate the book value of the car at the end of 5^{th} year by declining balance method and straight line method of depreciation. Also find the accumulated depreciation at the end of 6^{th} year by Declining Balance method. **(08 Marks)**

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CBCS SCHEME

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18ME53

Fifth Semester B.E. Degree Examination, July/August 2022
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 condition for static equilibrium of a body subjected to a system of
i) 2 Forces ii) 3 Forces iii) Member with two forces and torque. **(06 Marks)**

b. For the mechanism shown in Fig.Q1(b), find the required input torque for the static equilibrium. The length OA = 250mm, AB = 650mm, F = 500N.

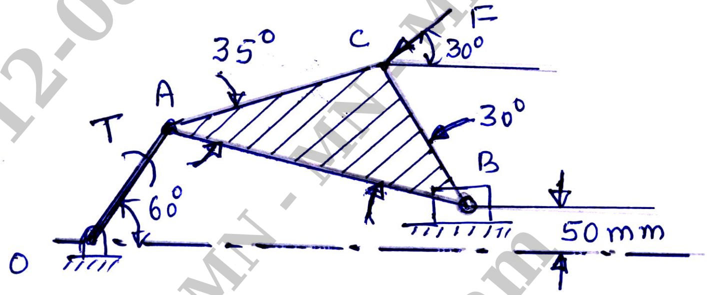

Fig.Q1(b) **(14 Marks)**

OR

2 a. Explain in brief 'D'Almert's principle. **(05 Marks)**

b. Derive an expression for the velocity and acceleration of piston and also the angular acceleration of the connecting rod of a reciprocating engine. **(15 Marks)**

Module-2

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

b. Four masses are attached to a shaft of planes A, B, C and D at equal radii. The distance of the planes B, C and D from A are 400mm, 50mm and 1200mm respectively. The masses at A, B and C are 60kg, 45kg and 70kg respectively. If the system is in complete balance, determine the mass at D and the position of masses B, C and D with respect to A. **(16 Marks)**

OR

4 A 5 cylinder inline engine running at 500r/min has successive cranks at 144° apart. The distance between the cylinder centre line is 300mm. Piston stroke = 240mm, Length of connecting rod is 480mm. Examine the engine for balance of primary and secondary forces and couples. Find the maximum value of these and position of central crank at which these maximum value occur. The reciprocating mass for each cylinder is 150N. **(20 Marks)**

Module-3

5 a. Define the following with respect to the working of governors. i) Sensitiveness ii) Isochronism iii) Effort of a governor iv) Stability of a governor. **(08 Marks)**

b. The arms of a porter governor are each 300mm long and are hinged on the axis of rotation. The mass of each ball is 5kg and mass of the sleeve is 15kg. The radius of rotation of the ball is 200mm when the governor beings to lift and 250mm when the governor is at the maximum speed. Determine :
i) Range is speed neglecting the sleeve friction
ii) Range of speed if the frictional force at the sleeve is 30N. **(12 Marks)**

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

OR

6 a. Explain in brief :
i) Angular momentum ii) Spin motion iii) Processional motion. **(06 Marks)**

b. A rail car has a total weight of 39240N, there are two axles, each which together with wheels has moment of inertia of 30kg-m^2. The centre distance between the two wheels on an axle is 1.5m and each wheel is of 370.5mm radius. Each axle is driven by a motor and its speed is 3 times the speed of wheel. Each motor has a moment of inertia of 15kg-m^2 and runs opposite to the of axle. The centre of gravity of 1050mm above rails. Determine the limiting speed when it is negotiating a curve of 240m radius such that no wheel leaves the rail. **(14 Marks)**

Module-4

7 a. Find the natural frequency of a spring mass system, the mass of the spring can be taken into account by adding one-third of its mass to the main mass. **(10 Marks)**

b. The cylinder of mass m, radius r rolls without slipping on a cylindrical surface of radius R. Determine the natural frequency for small oscillations about the lowest point. **(10 Marks)**

OR

8 a. Obtain the response of viscous damped system for critically damped case. **(10 Marks)**

b. Find the equation of motion for the system shown in Fig.Q8(b) when $\xi = 2$. If the mass m is displaced by a distance of 3cm and released.

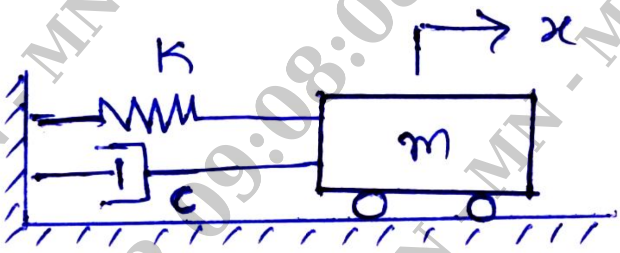

Fig.Q8(b) **(10 Marks)**

Module-5

9 a. What is magnification factor? Derive an expression for the same and discuss its variation with frequency ratio. **(10 Marks)**

b. A 75kg machine is mounted on springs of stiffness $K = 11.76 \times 10^5$ N/m with damper of $\xi = 0.2$. A 2kg piston within the machine has reciprocating motion with stroke of 0.08m and a speed of 3000r/min. Assuming the motion of the piston to be harmonic, determine the amplitude of vibration of the machine. **(10 Marks)**

OR

10 a. A shaft 40mm diameter and 2.5m long has a mass of 15kg per meter length. It is simply supported at the ends and carrier 3 masses 90kg, 140kg and 60kg at 0.8m, 1.5m and 2m respectively from the left support. Taking E = 200G N/m^2. Find the frequency of transverse vibration. **(10 Marks)**

b. Derive an expression for the critical speed of light shaft having single disc with damping. **(10 Marks)**

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CBCS SCHEME

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18ME54

Fifth Semester B.E. Degree Examination, July/August 2022
Turbomachines

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define a turbomachine. With a neat sketch, explain the parts of a turbomachine. **(06 Marks)**

b. Compare a turbomachine and a positive displacement machine. **(06 Marks)**

c. Define specific speed of pump. Derive an expression for the same in terms of discharge, speed and head. **(08 Marks)**

OR

2 a. Define Static and Stagnation States. **(04 Marks)**

b. Starting from the first law, derive an expression for the work output of a turbomachine. **(08 Marks)**

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

$$\eta_p = \left[\frac{n-1}{n}\right]\left[\frac{\gamma}{\gamma-1}\right]$$

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

Module-2

3 a. With a neat sketch derive an expression for Euler's turbine equation. **(10 Marks)**

b. At a 50% reaction stage axial flow turbine the mean blade diameter is 0.6 mts. The maximum utilization factor is 0.9 and steam flow rate is 10 kg/sec. Calculate the inlet and outlet absolute velocities and power developed if the speed is 2000 rpm. **(10 Marks)**

OR

4 a. Define degree of reaction for an axial flow machine. Prove that degree of reaction for an axial flow device with constant velocity of flow is given by

$$R = \frac{V_f}{2U}\left[\frac{\tan\beta_1 + \tan\beta_2}{\tan\beta_1 \tan\beta_2}\right]$$ **(10 Marks)**

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

Module-3

5 a. Define Steam Turbine. List the difference between impulse and reaction steam turbines. **(06 Marks)**

b. What is the necessity for compounding steam turbines? Name the different compounding methods. **(04 Marks)**

c. A single stage impulse turbine has a diameter of 1.5m and running at 3000 rpm. The nozzle angle is 20°. Speed ratio is 0.45. Ratio of relative velocity at the outlet to that at inlet is 0.9. The outlet angle of the blade is 3° less than inlet angle. Steam flow rate is 6 kg/sec. Draw the velocity diagrams and find the following:
(i) Velocity of Whirl (ii) Axial thrust (iii) Blade angles (iv) Power developed. **(10 Marks)**

OR

6 a. Prove that the maximum blade efficiency of a reaction turbine is given by

$$\eta_{b\max} = \frac{2\cos^2\alpha_1}{1+\cos^2\alpha_1}$$ **(10 Marks)**

b. In a reaction turbine, the inlet and outlet blade angles are 50° and 20° respectively. Steam enters at 18° to the plane of the rotor wheel and leaves at 40°. The rotor sped is 260 m/s. Calculate the speed ratio, specific work and degree of reaction. **(10 Marks)**

Module-4

7 a. Show that the maximum hydraulic efficiency of a Pelton wheel turbine is given by $\eta_{h\max} = \frac{1+C_b\cos\beta_2}{2}$. Also draw the inlet and exit velocity triangles. **(10 Marks)**

b. A double overhung Pelton wheel unit is to produce 30000 kW of a generator under an effective head 300m at the base of the nozzle. Find the size of the Jet, mean diameter of the runner, runner speed and specific speed of each Pelton turbine. Assume generator η = 93%, Pelton wheel efficiency = 0.85, speed ratio = 0.46, Jet velocity coefficient = 0.97 and Jet ratio = 12. **(10 Marks)**

OR

8 a. Draw a neat sketch of a Francis turbine and draw the inlet and outlet velocity triangles. **(06 Marks)**

b. Explain the function of a draft tube and mention its types. **(06 Marks)**

c. A Kaplan turbine develops 10 MW under an effective head of 8m. The overall efficiency is 0.86, the speed ratio is 2 and the flow ratio 0.6. The hub diameter of the wheel is 0.33 times the outside diameter of the wheel. Find the diameter and speed of the turbine. **(08 Marks)**

Module-5

9 a. Define the following for the Centrifugal Pump:

i) Manometric head
ii) Suction head
iii) Net Positive Suction Head [NPSH] **(06 Marks)**

b. Explain with a neat sketch, multistage centrifugal pump arrangement. **(04 Marks)**

c. A centrifugal pump having outer diameter equal to 2 times inner diameter and running at 1200 rpm works against a total head of 75m. The velocity of flow through the impeller is constant and equal to 3 m/s. The vanes are setback at an angle of 30° at outlet. If the outer diameter of impeller is 60 cm and width at outlet is 5 cm, determine i) Vane angle at inlet ii) Work done iii) Monometric efficiency. **(10 Marks)**

OR

10 a. With reference to centrifugal air compressor, explain the following :

i) Choking ii) Surging iii) Slip factor iv) Pressure coefficient **(08 Marks)**

b. What are the types of diffuser used in centrifugal compressor? **(02 Marks)**

c. A centrifugal compressor runs at a speed of 15000 rpm and delivers 30 kg/s of air. The exit diameter is 70 cm relative velocity at exit is 100 m/s at an exit angle of 75°. The total temperature at inlet is 300 K and total pressure at inlet is 1 bar. Determine

i) Power required to drive the compressor ii) Ideal head developed
iii) Work done iv) Total exit pressure. **(10 Marks)**

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CBCS SCHEME

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18ME56

Fifth Semester B.E. Degree Examination, July/August 2022
Operations Management

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define Operations Management and explain briefly how the production systems are classified. **(10 Marks)**

b. Explain briefly with a schematic model the functions within Business Organisation and Operations Management. **(10 Marks)**

OR

2 a. What is 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 and explain briefly the steps involved in Forecasting process. **(10 Marks)**

b. Briefly explain the components of Time Series method with sketches. **(10 Marks)**

OR

4 a. Explain the following methods :
i) Exponential Smoothing ii) Linear Regression. **(10 Marks)**

b. A Company adopts method of least squares to develop a linear trend equation for the data as shown in the table below :

Year (X)	1	2	3	4	5	6	7	8	9	10	11
Shipment in (Tons) (Y)	2	3	6	10	8	7	12	14	14	18	19

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

Module-3

5 a. Define the following : i) Design capacity ii) System capacity
iii) Capacity planning iv) Facility layout. **(10 Marks)**

b. Sketch and explain any two types of layouts. **(10 Marks)**

OR

6 a. List and explain the various factors influencing plant location. **(10 Marks)**

b. Sketch and explain the different types of layouts. **(10 Marks)**

Module-4

7 a. Define Aggregate and Master Scheduling. Explain the Pure strategies used for aggregate planning in brief. **(10 Marks)**

b. Discuss the techniques of aggregate planning process with flow chart. **(10 Marks)**

OR

8 a. What are the objectives and importance of Aggregate Planning? **(10 Marks)**
b. Explain Master Scheduling Methods. **(10 Marks)**

Module-5

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

OR

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

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CBCS SCHEME

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Sixth Semester B.E. Degree Examination, July/August 2022
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. Explain steps in finite element method. **(10 Marks)**

b. Explain simplex, complex and multiplex elements. **(10 Marks)**

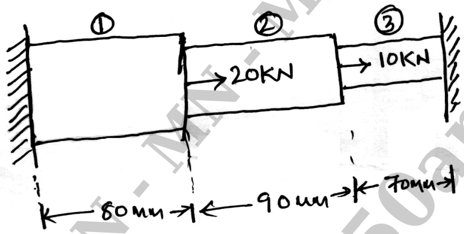
OR

2 a. Explain node numbering scheme. **(10 Marks)**

b. Obtain the shape functions for linear one dimension elements. **(10 Marks)**

Module-2

3 For the bar shown in Fig Q3, find the nodal displacements, stress in the middle portion and left support reaction.



$E_1 = 70$ GPa
$E_2 = 105$ GPa
$E_3 = 200$ GPa
$A_1 = 900\ mm^2$
$A_2 = 400\ mm^2$
$A_3 = 200\ mm^2$

Fig Q3 **(20 Marks)**

OR

4 A four bar truss element as shown in Fig Q4, determine nodal displacement and stress in each element. Area = $100 mm^2$ $E = 2 \times 10^5\ N/mm^2$

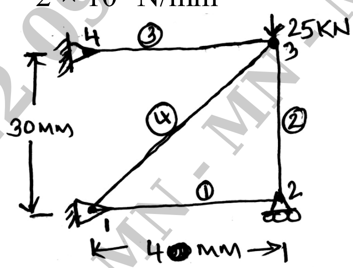


Fig Q4 **(20 Marks)**

Module-3

5 For the beam and loading shown in Fig Q5, determine mine the slopes at 2 and 3.

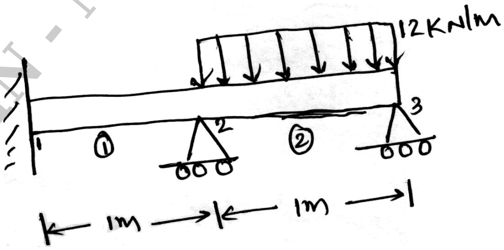


Fig Q5

Take : $E = 200$ GPa, $I = 4 \times 10^6 mm^4$ **(20 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.

OR

6 A bar of circular cross section having a diameter 50mm is firmly fixed at its ends. It is subjected to torque as shown in Fig Q6. Determine the angle of twist and shear stress. Take $G = 7 \times 10^4$ N/mm^2, $E = 2 \times 10^5$ N/mm^2.

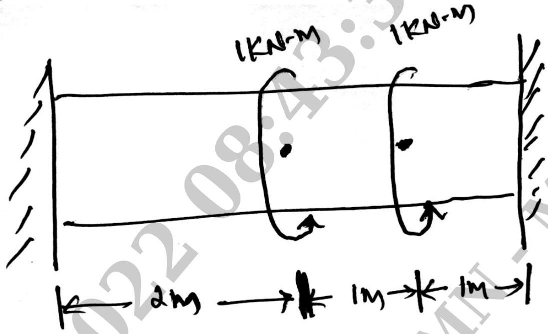
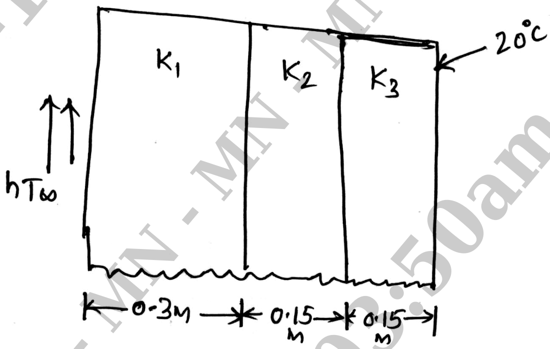


Fig Q6 **(20 Marks)**

Module-4

7 A composite wall consists of three materials, as shown in Fig Q7. The outer temperature is T_0 = 20ºC, convective heat transfer takes place on the inner surface of the wall with T_∞ = 800ºC and h = 25W/m^{2}ºC. Determine the temperature distribution in the wall.



K_1 = 20W/mºC
K_2 = 30W/mºC
K_3 = 50W/mºC

Fig Q7 **(20 Marks)**

OR

8 a. Derive stiffness matrix for flow through porous medium. **(10 Marks)**

b. Derive 1D heat conductive finite element matrix using variational method. **(10 Marks)**

Module-5

9 a. Derive shape function for axisymmetric triangular element. **(10 Marks)**

b. Derive stiffness matrix of axisymmetric bodies with triangular element. **(10 Marks)**

OR

10 For the stepped bar shown in Fig Q10, determine the Eigen values and Eigen vectors. Take $A_1 = 400$mm^2, $A_2 = 200$mm^2, $\rho = 7850$ kg/m^3, E = 200GPa.

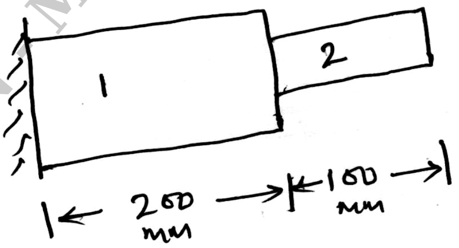


Fig Q10 **(20 Marks)**

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CBCS SCHEME

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18ME62

Sixth Semester B.E. Degree Examination, July/August 2022
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.

Module-1

1 a. Derive an expression for the stress induced in a helical spring with usual notations. **(10 Marks)**

b. Design a leaf spring for the following specifications for a truck total load = 120kN, number of springs = 4 material for the spring is chrome vanadium steel with permissible stress = 0.55GPa span of spring = 1100mm, width of central band = 100mm and allowable deflection = 80mm, number of full length leaves are 2 and graduated leaves 6. **(10 Marks)**

OR

2 a. Select a V-belt drive to transmit 10kW of power from a pulley of 200mm diameter mounted on a electric motor running at 720rpm to another pulley mounted on a compressor running at 200rpm. The approximate centre distance between the two pulleys is 600mm. The correction factor for service is 1.3. Find the number of belts and the correct centre distance. **(10 Marks)**

b. Select a suitable wire rope to a standard strand to lift a load of 10kN through a height of 600m from a mine. The weight of the bucket is 2.5kN. The load should attain a maximum speed of 50m/min in 2 seconds. **(10 Marks)**

Module-2

3 A 12kW motor running at 1170rpm drives a fan through a pair of spur gears forged steel SAE1030 pinion and cast iron gear with a reduction ratio of 3.9:1. Design the gear pair and check for dynamic and wear loads. **(20 Marks)**

OR

4 Design a steel helical gear pair from the following data power transmitted = 30kW, speed of pinion = 1500rpm, velocity ratio 4:1 number of teeth on pinion = 24, helix angle $\beta = 30°$, static stress for both pinion and gear = 50.7MPa $(BHN)_P = (BHN)_G = 350$ check the design from wear point of view also. **(20 Marks)**

Module-3

5 Design a pair of bevel gears to transmit a power of 25kW from a shaft rotating at 1200rpm to a perpendicular shaft to be rotated at 400rpm. **(20 Marks)**

OR

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

Module-4

7 a. Derive power transmitting capacity of a single plate clutch for:
i) Uniform pressure condition ii) Uniform wear condition. **(10 Marks)**

b. A plate clutch with a maximum diameter of 600mm has maximum lining pressure of 0.35MPa. The power to be transmitted at 400rpm is 135kW and $\mu = 0.3$, find the inside diameter and spring force required to engage the clutch if the spring with spring index 6 and material of the spring wire diameter, if 6 springs used. **(10 Marks)**

OR

8 a. In a band and block brake $\theta = 15°$ and effective diameter is 800mm, P = 0.4, a = 100mm, b = 25mm. The power absorbed at 600rpm is 450kW when the force applied at the end of levels at a distance of 1.20m from a fulcrum is 200N. Find the number of blocks. **(10 Marks)**

b. In a simple bank brake, the length of lever is 440mm. The tight end of the band is attached to the fulcrum of the lever and the slack end to a pin 50mm from the fulcrum. The diameter of the brake drum is 1m and arc of contact is 360°. The coefficient of friction between the band and the drum is 0.35. The brake drum is attached to a hoisting drum of diameter 0.65m that sustains a load of 20kN. Determine: i) Power required at the end ii) Width of steel if the tensile stress is $50N/mm^2$. **(10 Marks)**

Module-5

9 a. Derive Petroff's equation for a lightly loaded journal bearing with usual rotation. State the assumptions also. **(10 Marks)**

b. A full journal bearing 50mm diameter and 50mm long operates at 1000rpm and carries a load of 5kN. The radial clearance is 0.025mm. The bearing is lubricated with SAE 30 oil and the operating temperature is 80°C. Determine:
i) Bearing pressure
ii) Sommefeld number
iii) Minimum film thickness
iv) Heat generated
v) Heat dissipated, if the ambient temperature is 20°C
vi) Amount of artificial cooling necessary. **(10 Marks)**

OR

10 a. Explain the different types of bearings. What are the requirements of lubricant used in the bearings? **(10 Marks)**

b. Select a single-row deep groove ball bearing to carry a radial load of 4kN and a thrust load of 5kN operating at a speed of 1200rpm for an average life of 15 years working 10hrs/day. Assume there are 250 working days/year and loads are steady. **(10 Marks)**

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CBCS SCHEME

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18ME63

Sixth Semester B.E. Degree Examination, July/August 2022

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 Data Handbook and Seam tables are permitted.***

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 different modes of Heat transfer citing one example for each mode. **(05 Marks)**

b. A steam pipe of 4cm outer radius is covered with a layer of asbestos insulation of 1cm thickness , thermal conductivity, 0.15 W/m°C that is in turn covered by 3cm thick glass fibre insulation (K = 0.05 W/m° C). The surface of steam pipe is at 330°C and the outer surface of glass fibre layer is at 30°C. Determine interface temperature and the heat loss per meter length of pipe. **(07 Marks)**

c. Obtain the 3-D heat conduction equation in Cartesian co-ordinates stating the assumptions made. **(08 Marks)**

OR

2 a. What are Boundary Conditions? Explain BC 3rd kind for cylindrical geometry. **(05 Marks)**

b. A wire of 2mm diameter is heated electrically while it dissipates heat to the ambient with h = 125 W/m°C. If the wire is covered with 0.2mm thick insulation with K = 0.175 W/m° C. What are your interpretations on increase or decrease in heat loss from the wire? **(07 Marks)**

c. Explain the following terms with illustrations : i) Variable thermal conductivity
ii) Series and parallel arrangement of thermal resistances.
iii) Thermal diffusivity.
iv) Thermal contact resistance. **(08 Marks)**

Module-2

3 a. Explain the significance of fin efficiency and fin effectiveness. **(05 Marks)**

b. A cylinder 1m long and 50mm in diameter is placed in an ambience at 45°C with h = 17W/m^2 °C. It has 12 numbers of longitudinal straight fins (K = 120 W/m°C , height = 12.7mm , thickness = 0.76mm). Evaluate the total heat transfer rate if these fins behave as end – insulated fins when the cylinder surface temperature is held constant at 150°C. **(07 Marks)**

c. A spherical thermocouple junction of 0.706mm diameter measures gas temperature. The convective heat transfer coefficient on the bead surface is 400W/m^2 °C. If the properties of junction material are given to be K = 20W/m°C ; C_p = 400 J/kg K ; δ = 8500 kg/m^3. Estimate the time taken by bead of reach 298°C, when placed into a hot stream of gas at 300°C. The temperature of the bead is initially at 30°C. **(08 Marks)**

OR

4 a. Explain the significance of Biot number and Fourier number in transient heat conduction. **(05 Marks)**

b. An ordinary egg can be approximated as a sphere of 5cm diameter. The initial temperature of the egg is 5°C before it is dropped into 95°C water with convective heat transfer coefficient of 1200W/m^2 °C. Assume the egg properties to be same as that of water and evaluate the time required for the centre of egg to attain a temperature of 70°C. **(07 Marks)**

c. A hot surface at 100°C is to be cooled by attaching 100 numbers of pin fins 3cm long, 0.25cm diameter made of aluminum (end insulated).(K = 237 W/m°C) while surrounding medium is at 35W/m^2 C and 30°C. the 1m × 1m system has heat dissipation through these fins of equal size. Determine the rate of heat transfer from the fin mounted surface. **(08 Marks)**

Module-3

5 a. Explain Explicit scheme of solution to the One – dimensional transient heat conduction problem without heat generation. **(10 Marks)**

b. Briefly illustrate the applications connected with Stefan Boltzmann law. A surface is maintained at a temperature of 800K and radiates heat to another surface at 500K with a unity view factor. If the emissivity of the surfaces are 0.85 evaluate the net exchange of heat between these two surfaces by radiation process. **(10 Marks)**

OR

6 a. Briefly explain the use of numerical techniques to solve the heat transfer problems. Explain the process of discretizate based on finite difference methodology. **(10 Marks)**

b. Explain the following laws with reference to thermal radiation heat transfer :
i) Stefan – Boltzmann law ii) Wein – Displacement law iii) Kirchhoff's law
iv) Lamberts Cosine rule. **(10 Marks)**

Module-4

7 a. Explain the formation of boundary layers (thermal and hydrodynamic) for flow over a flat plate. **(05 Marks)**

b. Engine oil at 60°C flows over the upper surface of a 5m long flat plate whose temperature is 20°C with a velocity of 2m/s. Determine the total drag force and the rate of heat transfer per unit width of plate. **(07 Marks)**

c. Distinguish between Free convection and Forced convection on basis of the associated dimensional numbers. **(08 Marks)**

OR

8 a. Explain the concept of developed and developing flow with respect to internal flow through circular pipe. **(05 Marks)**

b. A long 10cm diameter steam pipe whose external surface is at 110°C passes through some open area that is not protected against winds. Determine the rate of heat loss from the pipe when air is at 1 atmp and 10°C moving at 8m/s. **(07 Marks)**

c. A 6m long section of an 8cm diameter horizontal pipe passes through a large room whose temperature is 20°C. If the outer surface temperature of the pipe is 70°C, evaluate the rate of heat loss from the pipe by natural convection. **(08 Marks)**

Module-5

9 a. Discuss the different regimes of pool boiling curve. **(10 Marks)**

b. Steam condenses at 60°C on shell side of a steam condenser , while cooling water flows inside tubes at 3kg/S. The inlet and outlet temperature of water are 20°C and 50°C respectively. Considering U_m = 2000 W/m^2°C. Calculate the surface area required. **(10 Marks)**

OR

10 a. Distinguish between Drop wise and Film wise condensation. **(08 Marks)**

b. A 2 – shell pass , 4 tube pass heat exchanger is used to cool processed water from 75°C to 25°C on the tube side at a rate of 5kg/S with cold water entering shell side at 10°C with flow rate of 6kg/S. If U_m = 750 W/m^2 °C, find heat exchange area. **(12 Marks)**

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CBCS SCHEME

USN | | | | | | | | | | **18ME641**

Sixth Semester B.E. Degree Examination, July/August 2022
Non-Traditional Machining

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define Non-Traditional Machining Process. Explain the need for non-traditional machining process. **(06 Marks)**

b. Discuss briefly the classification of Non-Traditional Machining process based on different sources of energy. **(06 Marks)**

c. What are the specific advantages, limitations and applications of Non-Traditional machining process? **(08 Marks)**

OR

2 a. Differentiate between conventional (traditional) and Non-Traditional machining process. **(08 Marks)**

b. Write in brief note on the selection of Non-Traditional Machining process. **(08 Marks)**

c. Write history about Non-Traditional Machining. **(04 Marks)**

Module-2

3 a. With the help of neat sketch, explain working principle of ultrasonic machining process. **(08 Marks)**

b. Discuss the effects of the following parameters on the rate and material removal and surface finish obtained in ultrasonic machining:

i) Amplitude and frequency of vibration
ii) Static load
iii) Abrasive grid size. **(06 Marks)**

c. List the advantages and disadvantages of ultrasonic machining process. **(06 Marks)**

OR

4 a. Explain the working principle of abrasive jet machining process with the help of neat diagram. Mention its advantages. **(10 Marks)**

b. With a neat sketch, explain the following variables that influence the MRR in AJM.

i) Standoff distance
ii) Types of abrasive
iii) Carrier gas
iv) Velocity of the abrasive jet
v) Work material. **(10 Marks)**

Module-3

5 a. Explain the working principle of electro chemical machining with the help of neat sketch. **(08 Marks)**

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

c. Explain the following ECM process characteristics:

i) Material removal rate
ii) Accuracy
iii) Surface finish. **(06 Marks)**

OR

6 a. Explain with neat sketches of chemical blanking process and chemical milling process. **(08 Marks)**

b. Explain the following in chemical machining process:
i) Maskants ii) Etchants. **(06 Marks)**

c. What are the advantages, disadvantages and applications of chemical machining process? **(06 Marks)**

Module-4

7 a. With the help of a neat diagram, working principle of electrical discharge machining process. **(08 Marks)**

b. Explain the different methods of dielectric flushing in electrical discharge machining. **(06 Marks)**

c. Sketch and explain travelling wire EDM process. **(06 Marks)**

OR

8 a. Explain with neat diagram, construction and working principle of Plasma Arc Machining (PAM). **(08 Marks)**

b. What are the safety precautions in PAM? Explain. **(06 Marks)**

c. What are the advantages and disadvantages of PAM. **(06 Marks)**

Module-5

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

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

c. What are the advantages and limitations of LBM process? **(06 Marks)**

OR

10 a. Explain working of electron beam machining process with the help of neat sketch. **(08 Marks)**

b. Explain the equipments used in the Electron Beam Machining (EBM). **(06 Marks)**

c. Write the advantages and applications of Electron beam machining process. **(06 Marks)**

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CBCS SCHEME

USN | | | | | | | | | | | **18ME651**

Sixth Semester B.E. Degree Examination, July/August 2022

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. With neat sketch explain hydro power plant. **(10 Marks)**
b. List the advantages and disadvantages of non-conventional energy sources. **(10 Marks)**

OR

2 a. With a neat sketch, explain pyrheliometer. **(10 Marks)**
b. What is need of alternative energy sources? Explain by considering solar energy. **(10 Marks)**

Module-2

3 a. Define : (i) Solar latitude (ii) Declination angle (iii) Zenith angle (iv) Hour angle (v) Surface azimuth angle **(10 Marks)**
b. With a neat sketch, explain working principle of solar pond. **(10 Marks)**

OR

4 a. With neat sketch, explain solar energy water heating. **(10 Marks)**
b. Explain the following:
(i) Sensible heat storage. (ii) Latent heat storage. **(10 Marks)**

Module-3

5 a. List and explain the various parameters that effect the performance of flat plate collectors. **(10 Marks)**
b. Write notes on collector efficiency factor and collector flow factor. **(10 Marks)**

OR

6 a. With a neat sketch, explain photovoltaic conversion. **(10 Marks)**
b. Explain the application of solar cell for traffic lighting with a circuit diagram. **(10 Marks)**

Module-4

7 a. List the types of wind mills. Explain horizontal axis wind machine. **(10 Marks)**
b. List the advantages, disadvantages and applications of wind energy. **(10 Marks)**

OR

8 a. With a neat sketch, explain the operation of tidal power plant. **(10 Marks)**
b. List the advantages and disadvantages of Tidal plants. **(10 Marks)**

Module-5

9 a. With a neat sketch, explain Geothermal energy system by Hot Dry Rock (HDR). **(10 Marks)**
b. List and explain the problems associated with geothermal system operation. **(10 Marks)**

OR

10 a. Explain the biomass sources available for biogas generation. **(10 Marks)**
b. With neat sketch, explain Batch type Biogas plants. **(10 Marks)**

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CBCS SCHEME

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18ME71

Seventh Semester B.E. Degree Examination, July/August 2022
Control Engineering

Time: 3 hrs. Max. Marks: 100

Note: **1.** ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Draw neat sketches, wherever required.***

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 the closed loop control system with an example and block diagram. **(05 Marks)**
b. Explain the requirements of an ideal control system (any five). **(05 Marks)**
c. Explain the following controllers : (i) PI controller (ii) PID controller. **(10 Marks)**

OR

2 a. Obtain the transfer function for an Armature Controlled DC motor. **(10 Marks)**
b. Obtain the transfer function for the mechanical system shown in Fig. Q2 (b). **(10 Marks)**

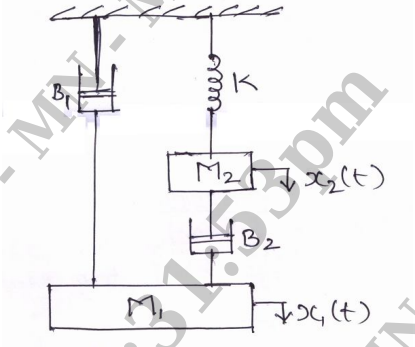

Fig. Q2 (b)

Module-2

3 a. Analyze the first order electrical system when it is subjected to an unit step input. **(08 Marks)**
b. A second order system is given by, $\frac{C(s)}{R(s)} = \frac{20}{s^2 + 6s + 25}$. Find the following transient response specifications, (i) Rise time (ii) Delay time (iii) Peak time (iv) Peak overshoot (v) Settling time.
Also find the expression for the output response C(t) when subjected to unit step response. **(12 Marks)**

OR

4 a. For an unity feed back system with $G(s) = \frac{K}{s^2(s+3)(s+4)}$, find the value of K for which the steady state error is to be limited to 10, when the input is $1 + 12t + \frac{50}{2}t^2$. **(08 Marks)**
b. Derive an expression for a second order sender damped system which is subjected to unit step response. **(12 Marks)**

Module-3

5 a. Reduce the block diagram by reduction technique and find $\frac{C(s)}{R(s)}$ shown in Fig. Q5 (a). **(10 Marks)**

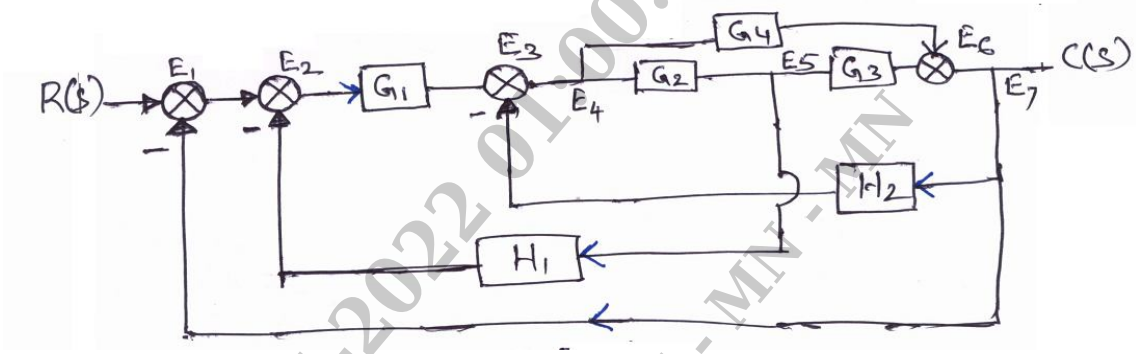

Fig. Q5 (a)

b. Determine the transfer function of the system shown in Fig. Q5 (b) using SFG technique.

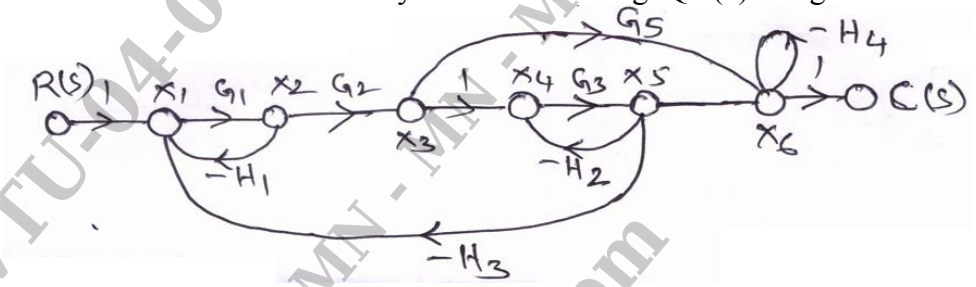

Fig. Q5 (b) **(10 Marks)**

OR

6 a. Define the following terms :
- (i) State
- (ii) State variables
- (iii) State vector.
- (iv) State space
- (v) State trajectory **(05 Marks)**

b. Determine the state controllability and observability of the system using Kalman's test.

$$\dot{X} = \begin{vmatrix} -3 & 1 & 1 \\ -1 & 0 & 1 \\ 0 & 0 & 1 \end{vmatrix} X + \begin{vmatrix} 0 & 1 \\ 0 & 0 \\ 2 & 1 \end{vmatrix} u, \quad Y = \begin{bmatrix} 0 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix} x$$ **(10 Marks)**

c. Evaluate the observability of the system by Gilbert's method.

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -2 & -3 \end{bmatrix}, \quad B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \text{ and } C = \begin{bmatrix} 3 & 4 & 1 \end{bmatrix}.$$ **(05 Marks)**

Module-4

7 Sketch the root locus for the given transfer function with $G(s)H(s) = \frac{K}{s(s+2)(s+4)(s+6)}$.

Comment on the stability of the system. **(20 Marks)**

OR

8 a. A system oscillates with a frequency ω, if it has poles of $s = \pm j\omega$ and no poles in the right half of S plane, determine the value of 'K' and 'a', so that the system shown in Fig. Q8 (a) oscillates at a frequency of 2 rad/s. **(06 Marks)**

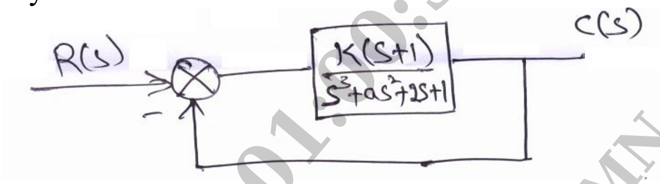

Fig. Q8 (a)

b. Sketch the root locus with $G(s)H(s) = \dfrac{K}{s(s^2 + 4s + 10)}$. Comment on the stability. **(14 Marks)**

Module-5

9 a. What are Polar Plots? Sketch the Polar Plot with $G(s)H(s) = \dfrac{1}{s(1+T_1 s)(1+T_2 s)}$. **(06 Marks)**

b. Draw the Nyquist plot for $G(s)H(s) = \dfrac{K}{s^4 + 8s^3 + 17s^2 + 10s}$ and find the value of K. **(14 Marks)**

OR

10 Sketch the Bode plot for the system with $G(s)H(s) = \dfrac{2(s+0.25)}{s^2(1+s)(s+0.5)}$. From the plot determine, (i) Phase cross over frequency (ii) gain cross over frequency (iii) Gain margin (iv) Phase margin.
Comment on the stability of the system. **(20 Marks)**

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CBCS SCHEME

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18ME751

Seventh Semester B.E. Degree Examination, July/August 2022
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. Intercept world energy scenario with respect to production and consumption using relevant statistics. **(10 Marks)**

b. Outline the factors that affect India's energy development. **(10 Marks)**

OR

2 a. Explain various key energy trends in India. **(10 Marks)**

b. Define following:
(i) Energy (ii) Forms of energy
(iii) Power (iv) Energy versus power **(10 Marks)**

Module-2

3 a. List the various thermal energy storage methods. Explain the working principle for solar pond with neat sketch. **(10 Marks)**

b. Explain:
(i) Objective of energy management
(ii) Audit
(iii) Sample report content of energy audit **(10 Marks)**

OR

4 a. Elaborate the different phases provided in detailed energy audit methodology. **(10 Marks)**

b. A power plant of 200 MW installed capacity has following particulars:
Capital cost = Rs.16,000/KW installed
Interest and depreciation = 12%
Annual load factor = 60%
Annual capacity factor = 54%
Annual running charges = Rs.200×10^6
Energy consumed by power plant auxiliaries = 6%
Calculate the cost of power generation per kWh. **(10 Marks)**

Module-3

5 a. What is ecosystem? Explain different types of forest ecosystem. **(10 Marks)**

b. Explain the following terms:
(i) Food chain
(ii) Food web
(iii) Ecological pyramid **(10 Marks)**

OR

6 a. Identify the need for public awareness on environment management. Discuss the effort of important institutions and people in environment management. **(10 Marks)**

b. Discuss how carbon is utilized in the ecosystem with the help of a simple flow diagram. **(10 Marks)**

Module-4

7 a. Explain main source and effects of air pollution. **(10 Marks)**

b. Enumerate the roll of an individual in prevention of pollution. **(10 Marks)**

OR

8 a. Discuss strategy and techniques involved in solid waste management. **(10 Marks)**

b. Discuss any two case studies related to pollution of environment in detail. **(10 Marks)**

Module-5

9 a. Write a short note on global warming. **(10 Marks)**

b. What is the need for wasteland reclamation? Explain the methods for reclaiming the wasteland. **(10 Marks)**

OR

10 a. What is acid rain? What are its effects and write a short note on ozone layer depletion? **(10 Marks)**

b. Discuss Environmental Protection Act and its features. **(10 Marks)**

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CBCS SCHEME

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18ME81

Eighth Semester B.E. Degree Examination, July/August 2022
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. Briefly explain the various step involved in coal handling. **(10 Marks)**

b. With a neat sketch, explain the working principle of Benson boiler. **(10 Marks)**

OR

2 a. With a neat sketch, explain the functions of super heater and air pre heater in thermal power plant. **(10 Marks)**

b. With a neat sketch, explain the working of Induced draught cooling tower. **(10 Marks)**

Module-2

3 a. Name solar radiation measuring instruments and explain pyranometer with a neat sketch to measure beam and diffused radiation. **(10 Marks)**

b. With the help of a neat sketch, explain the construction and working principle of solar pond. **(10 Marks)**

OR

4 a. Explain the working of Down draft gasifier with a neat sketch. **(10 Marks)**

b. With a neat sketch, explain the working principle of Janta biogas digester. **(10 Marks)**

Module-3

5 a. With a neat sketch, explain the working of Hot dry rock geothermal plant. **(10 Marks)**

b. With a neat sketch, explain the arrangement of single basin and double basin for tidal power plant. **(10 Marks)**

OR

6 a. With a block diagram, explain the basic components of wind energy conversion system. **(10 Marks)**

b. With a neat sketch, explain horizontal axis and vertical axis wind machines. **(10 Marks)**

Module-4

7 a. With a neat sketch, explain pumped storage hydroelectric power plant. **(10 Marks)**

b. The runoff data of a river at a particular site is tabulated below:

Month	Mean discharge per month (millions of m^3)	Month	Mean discharge per month (millions of m^3)
January	40	July	75
February	25	August	100
March	20	September	110
April	10	October	60
May	0	November	50
June	50	December	40

(i) Draw a hydrograph and find the mean flow.

(ii) Also draw the flow duration curve.

(iii) Find the power in MW available at mean flow if the head available is 80 m and overall efficiency of generation is 85%. Take each month of 30 days. **(10 Marks)**

OR

8 a. With a diagram, explain closed Rankine cycle OTEC system. **(10 Marks)**

b. List the problems associated with Ocean Thermal Energy Conversion (OTEC). **(04 Marks)**

c. Explain the following terms related to hydroelectric power plant:

(i) Surge tank. (ii) Penstock **(06 Marks)**

Module-5

9 a. Explain the principle of release of nuclear energy by fusion and fission reaction. **(10 Marks)**

b. Write a short note on Nuclear fuels used in the reactors. **(05 Marks)**

c. Explain : (i) Thermal utilization factor. (ii) Multiplication factor. **(05 Marks)**

OR

10 a. Explain the following:

(i) Reactor shielding.

(ii) Radioactive waste disposal. **(10 Marks)**

b. With a neat sketch, explain the working of Pressurized Water Reactor (PWR). **(10 Marks)**

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CBCS SCHEME

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18ME823

Eighth Semester B.E. Degree Examination, July/August 2022
Non Destructive Testing and Evaluation

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define Non Destructive Testing (NDT). Compare Non Destructive Testing with Mechanical or Destructive Testing. **(10 Marks)**

b. Describe the merits and limitations of Non Destructive Testing (NDT). **(10 Marks)**

OR

2 a. Define aided and unaided visual inspection and explain microscope and telescope aid for visual inspection. **(10 Marks)**

b. Explain Borescope and Holography. **(10 Marks)**

Module-2

3 a. Explain the principle of liquid penetrant test with a neat sketch and types of penetrants. **(10 Marks)**

b. List the types of developers and explain water washable method of liquid penetrant testing. **(10 Marks)**

OR

4 a. Define:
i) Magnetic flux density
ii) Magnetizing force
iii) Reluctance
iv) Magnetic forces
v) Magnetic field. **(10 Marks)**

b. Explain types of magnetization techniques with neat sketch. **(10 Marks)**

Module-3

5 a. Briefly describe any five types of non contact thermal inspection sensors. **(10 Marks)**

b. Describe liquid crystals and technique for applying liquid crystals. **(10 Marks)**

OR

6 a. Explain with a neat sketch principle of Eddy current testing and list its limitations. **(10 Marks)**

b. Explain absolute and differential arrangement of coils used in eddy current inspection. **(10 Marks)**

Module-4

7 a. Explain A-scan, B-scan and C-scan modes of display. **(10 Marks)**

b. Explain with neat sketch straight beam and angle beam pulse echo method. **(10 Marks)**

OR

8 a. Explain with a neat sketch principle of Acoustic Emission technique and list its applications. **(10 Marks)**

b. With block diagram, explain instrumentation for acoustic emission technique. **(10 Marks)**

Module-5

9 a. Explain with a neat sketch principle of radiography inspection and its applications. **(10 Marks)**

b. What is a penetrameter? Explain the types and characteristics of penetrameter. **(10 Marks)**

OR

10 a. Explain with a neat sketch principle of fluoroscopy and its major limitations. **(10 Marks)**

b. Explain computed tomography. **(10 Marks)**

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