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VTU Question Papers

Mechanical engineering-III,V & VII Semester

Feb/Mar-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

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18MAT31

Third Semester B.E. Degree Examination, Feb./Mar. 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.

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.

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Module-1

1 a. Evaluate (i) $L\left\{\frac{\cos 2t - \cos 3t}{t}\right\}$ (ii) $L(t^2 e^{-3t} \sin 2t)$ **(06 Marks)**

b. If $f(t) = \begin{cases} t, & 0 \le t \le a \\ 2a - t, & a \le t \le 2a \end{cases}$, $f(t + 2a) = f(t)$ then show that $L(f(t)) = \frac{1}{s^2}\tanh\left(\frac{as}{2}\right)$ **(07 Marks)**

c. Solve by using Laplace Transforms

$\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 4y = e^{-t}$, $y(0) = 0$, $y'(0) = 0$ **(07 Marks)**

OR

2 a. Evaluate $L^{-1}\left(\frac{4s+5}{(s+1)^2(s+2)}\right)$ **(06 Marks)**

b. Find $L^{-1}\left(\frac{s}{(s^2+a^2)^2}\right)$ by using convolution theorem. **(07 Marks)**

c. Express $f(t) = \begin{cases} \sin t, & 0 \le t < \pi \\ \sin 2t, & \pi \le t < 2\pi \\ \sin 3t, & t \ge 2\pi \end{cases}$

in terms of unit step function and hence find its Laplace Transform. **(07 Marks)**

Module-2

3 a. Obtain fourier series for the function $f(x) = |x|$ in $(-\pi, \pi)$ **(06 Marks)**

b. Expand $f(x) = \frac{(\pi - x)^2}{4}$ as a Fourier series in the interval $(0, 2\pi)$ and hence deduce that

$\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \ldots\ldots\ldots$ **(07 Marks)**

c. Express y as a Fourier series upto the second harmonic given :

x:	0	60	120	180	240	300
y:	4	3	2	4	5	6

(07 Marks)

OR

4 a. Find the Half-Range sine series of $\pi x - x^2$ in the interval $(0, \pi)$ **(06 Marks)**

b. Obtain fourier expansion of the function $f(x) = 2x - x^2$ in the interval $(0, 3)$. **(07 Marks)**

c. Obtain the Fourier expansion of y upto the first harmonic given :

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

(07 Marks)

Module-3

5 a. If $f(x) = \begin{cases} 1, & |x| < a \\ 0, & |x| > a \end{cases}$, find the Fourier transform of f(x) and hence find the value of $\int_0^\infty \frac{\sin x}{x} dx$ **(06 Marks)**

b. Find the infinite Fourier cosine transform of $e^{-\alpha x}$. **(07 Marks)**

c. Solve using z-transform $y_{n+2} - 4y_n = 0$ given that $y_0 = 0$, $y_1 = 2$ **(07 Marks)**

OR

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

b. Obtain the z-transform of cos nθ and sin nθ. **(07 Marks)**

c. Find the inverse z-transform of $\frac{4z^2 - 2z}{z^3 - 5z^2 + 8z - 4}$ **(07 Marks)**

Module-4

7 a. Solve $\frac{dy}{dx} = x^3 + y$, y(1) = 1 using Taylor's series method considering up to fourth degree terms and find y(1.1). **(06 Marks)**

b. Given $\frac{dy}{dx} = 3x + \frac{y}{2}$, y(0) = 1 compute y(0.2) by taking h = 0.2 using Runge – Kutta method of fourth order. **(07 Marks)**

c. If $\frac{dy}{dx} = 2e^x - y$, y(0) = 2, y(0.1) = 2.010, y(0.2) = 2.040 and y(0.3) = 2.090, find y(0.4) correct to 4 decimal places using Adams-Bashforth method. **(07 Marks)**

OR

8 a. Use fourth order Runge-Kutta method, to find y(0.8) with h = 0.4, given $\frac{dy}{dx} = \sqrt{x+y}$, y(0.4) = 0.41 **(06 Marks)**

b. Use modified Euler's method to compute y(20.2) and y(20.4) given that $\frac{dy}{dx} = \log_{10}\left(\frac{x}{y}\right)$ with y(20) = 5 Taking h = 0.2. **(07 Marks)**

c. Apply Milne's predictor-corrector formulae to compute y(2.0) given $\frac{dy}{dx} = \frac{x+y}{2}$ with

x	0.0	0.5	1.0	1.5
y	2.000	2.6360	3.5950	4.9680

(07 Marks)

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Module-5

9 a. Using Runge-Kutta method, solve

$\frac{d^2y}{dx^2} = x\left(\frac{dy}{dx}\right)^2 - y^2$, for x = 0.2, correct to four decimal places, using initial conditions $y(0) = 1, y'(0) = 0$ **(07 Marks)**

b. Derive Euler's equation in the standard form viz, $\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$ **(07 Marks)**

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

OR

10 a. Given the differential equation $2\frac{d^2y}{dx^2} = 4x + \frac{dy}{dx}$ and the following table of initial values:

x	1	1.1	1.2	1.3
y	2	2.2156	2.4649	2.7514
y′	2	2.3178	2.6725	2.0657

Compute y(1.4) by applying Milne's Predictor-corrector formula. **(07 Marks)**

b. Prove that geodesics of a plane surface are straight lines. **(07 Marks)**

c. On what curves can the functional $\int_0^1 (y'^2 + 12xy)\,dx$ with y(0) = 0, y(1) = 1 can be extremized? **(06 Marks)**

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18MATDIP31

Third Semester B.E. Degree Examination, Feb./Mar. 2022
Additional Mathematics – I

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. Find the modulus and amplitude of the complex number : $\frac{(2-3i)(2+i)^2}{1+i}$. **(07 Marks)**

b. Prove that $\left(\frac{1+\cos\theta+i\sin\theta}{1+\cos\theta-i\sin\theta}\right)^n = \cos n\theta + i\sin n\theta$. **(06 Marks)**

c. Show that the vectors $\vec{a}-2\vec{b}+3\vec{c}$, $-2\vec{a}+3\vec{b}-4\vec{c}$, $-\vec{b}+2\vec{c}$ are coplanar. **(07 Marks)**

OR

2 a. Given $\vec{a}=2\hat{i}+2\hat{j}-\hat{k}$, $\vec{b}=6\hat{i}-3\hat{j}+2\hat{k}$. Find : i) $\vec{a}\cdot\vec{b}$ ii) $\vec{a}\times\vec{b}$ iii) $|\vec{a}\times\vec{b}|$. **(07 Marks)**

b. Determine the value of λ, so that $\vec{a}=2\hat{i}+\lambda\hat{j}-\hat{k}$, and $\vec{b}=4\hat{i}-2\hat{j}-2\hat{k}$, are perpendicular. **(06 Marks)**

c. Express $1-i\sqrt{3}$ in the polar form and hence find its modulus and amplitude. **(07 Marks)**

Module-2

3 a. Using Euler's theorem, prove that $xu_x + yu_y = -3\cot u$ where $u=\sin^{-1}\left(\frac{x^2y^2}{x+y}\right)$. **(07 Marks)**

b. Using Maclaurin's series, prove that $\sqrt{1+\sin 2x} = 1 + x - \frac{x^2}{2} - \frac{x^3}{3} + \frac{x^4}{24} + \ldots$. **(06 Marks)**

c. If $u = x + 3y^2$, $v = 4x^2yz$, $w = 2z^2 - xy$, evaluate $\frac{\partial(u,v,w)}{\partial(x,y,z)}$ at the point (1, –1, 0). **(07 Marks)**

OR

4 a. Obtain Maclaurin's series expansion for the function e^x upto x^4. **(07 Marks)**

b. If $u=\sin^{-1}\left[\frac{x^3+y^3}{x+y}\right]$ prove that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=2\tan u$. **(06 Marks)**

c. If $u=f\left(\frac{x}{y},\frac{y}{z},\frac{z}{x}\right)$, prove that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}+z\frac{\partial u}{\partial z}=0$. **(07 Marks)**

Module-3

5 a. A particle moves along the curve $x = (1 - t^3)$, $y = (1 + t^2)$, $z = (2t - 5)$ determine its velocity and acceleration at t = 1 sec. **(07 Marks)**

b. If $\vec{F}=2x^2\hat{i}-3yz\hat{j}+xz^2\hat{k}$, and $\phi = 2z - x^3y$, find $\vec{F}\cdot(\nabla\phi)$ and $\vec{F}\times(\nabla\phi)$ at (1, –1, 1). **(06 Marks)**

c. Find the constants a, b, c so that $\vec{f}=(x+2y+az)\hat{i}+(bx-3y-z)\hat{j}+(4x+cy+2z)\hat{k}$ is irrotational. **(07 Marks)**

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OR

6 a. Find the directional derivate of $\phi = x^2yz + 4xz^2$ at (1,–2,–1) along $\vec{a} = 2\hat{i} - \hat{j} - 2\hat{k}$ **(07 Marks)**

b. Find curl $\vec{f}$ given that $\vec{f} = xyz^2\,\hat{i} + xy^2z\,\hat{j} + x^2yz\,\hat{k}$. **(06 Marks)**

c. If $\vec{f} = x^2i + y^2j + z^2k$ and $\vec{g} = yzi + zxj + xyk$. Show that $\vec{f} \times \vec{g}$ is a solenoidal vector. **(07 Marks)**

Module-4

7 a. Obtain the reduction formula, $I_n = \int \cos^n x dx$, where n is a positive integer. **(07 Marks)**

b. Evaluate $\int_0^1 \int_x^{\sqrt{x}} xydydx$. **(06 Marks)**

c. Evaluate $\int_0^1 \int_0^1 \int_0^1 (x + y + z)dxdydz$. **(07 Marks)**

OR

8 a. Evaluate : $\int_0^{\pi/6} \sin^6(3x)dx$. **(07 Marks)**

b. Evaluate : $\int_0^{\pi} x \sin^4 x \cos^6 x\, d\, x$. **(06 Marks)**

c. Evaluate $\int_0^1 \int_0^1 \int_0^y xyz\, dxdydz$. **(07 Marks)**

Module-5

9 a. Solve : $(2x + y + 1)\, dx + (x + 2y + 1)\, dy = 0$. **(07 Marks)**

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

c. Solve : $y(2xy + e^x)\, dx - e^x\, dy = 0$. **(07 Marks)**

OR

10 a. Solve : $(5x^4 + 3x^2y^2 - 2xy^3)dx + (2x^3y - 3x^2y^2 - 5y^4)dy = 0$. **(07 Marks)**

b. Solve : $y(2xy + 1)dx - x\, dy = 0$. **(06 Marks)**

c. Solve : $\frac{dy}{dx} + y \cot x = \cos x$. **(07 Marks)**

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18ME32

Third Semester B.E. Degree Examination, Feb./Mar. 2022
Mechanics of Materials

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 i) Poisson's ratio ii) Stress iii) Percentage Reduction in area iv) Toughness. **(04 Marks)**

b. Derive the relationship between Modulus of Rigidity and Modulus of elasticity. **(06 Marks)**

c. A stepped bar is subjected to an external loading as shown in Fig. Q1(c). Calculate the change in the length of bar. Take E = 200GPa for steel , E = 70 GPA for Aluminum and E = 100 GPa for copper. **(10 Marks)**

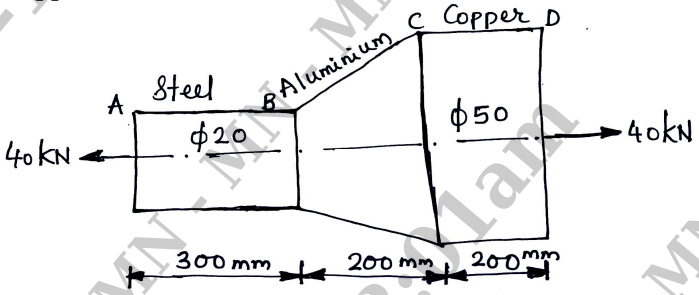


Fig. Q1(c)

OR

2 a. Draw Stress – Strain diagram for mild steel subjected to tension and indicate salient points on the diagram. **(06 Marks)**

b. A composite section comprises of a steel tube 10cm internal diameter and 12cm external diameter fitted inside a brass tube of 14cm internal diameter and 16cm external diameter. The assembly is subjected to a compressive load of 500kN. Find the load carried by each tube and change in the length of tubes. The length of tube is 150cm. Take E_S = 200 GPa and E_b = 100 GPa. **(08 Marks)**

c. The bronze bar 3m long with 320mm^2 cross sectional area is placed between two rigid walls. At -20°C there is a gap Δ = 2.5mm as shown in Fig. Q2(c). Find the magnitude and the type of stress induced in the bar when it is heated to a temperature 60°C. Take E = 80GPa and $\alpha_B = 18 \times 10^{-6}$/°C. **(06 Marks)**

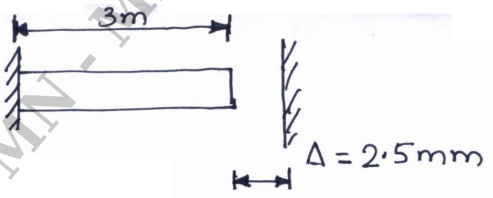
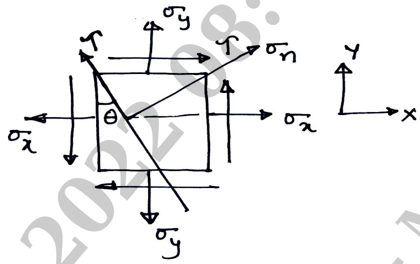


Fig. Q2(c)

Module-2

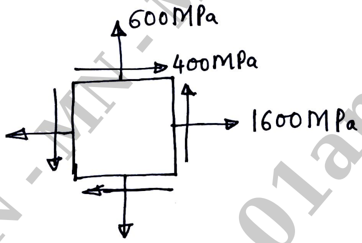
3 a. Derive the expression for normal stress and tangential stress on a plane inclined at θ° to the vertical axis in a biaxial stress system with shear stress as shown in Fig.Q3(a). Also find Resultant stress and Angle of Obliquity. **(10 Marks)**

Fig. Q3(a)



b. The state of stress at a point in a strained material as shown in Fig. Q3(b). Determine
   i) The principal stresses and principal planes.
   ii) Maximum shear stress and plane on which it is acting. Also find the normal stress on the maximum shear plane.
   iii) Sketch the element aligned with planes of principal stresses and planes of maximum shear. **(10 Marks)**

Fig. Q3(b)



OR

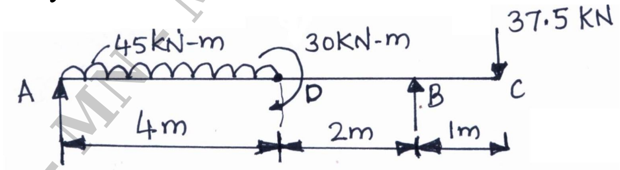
4 a. A thin cylinder of 75mm internal diameter and 250mm long has 2.5mm thick walls. The cylinder is subjected to an internal pressure of $7MN/m^2$. Determine the change in internal diameter and change in length and change in volume of cylinder. Also compute the Hoop stress and Longitudinal stress and maximum shear stress. Take E = 200GPa and μ = 0.3. **(10 Marks)**

b. A thick cylinder with internal diameter 80mm and external diameter 120mm is subjected to an external pressure of $40kN/m^2$, when the internal pressure is $120kN/m^2$. Calculate the circumferential stress at external and internal surfaces of the cylinder. Plot the variation of circumferential stress and radial pressure on the thickness of the cylinder. **(10 Marks)**

Module-3

5 Draw Shear force and Bending moment diagrams for the beam shown in Fig. Q5. Locate the point of contra flexure if any. **(20 Marks)**

Fig. Q5



OR

6 a. A simply supported of beam span 5m has a cross section of 150mm × 250mm. If the permissible stress is $20N/mm^2$. Find
   i) Maximum intensity of uniformly distributed load it can carry.
   ii) Maximum concentrated load P applied at 2m from one end it can carry. **(10 Marks)**

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b. The cross section of a beam is a T section (Fig. Q6(b)) 150mm × 100mm × 15mm with 150mm horizontal. Find the maximum intensity of shear stress and sketch the shear stress distribution across the section if it has to resist a shear force of 90kN. **(10 Marks)**

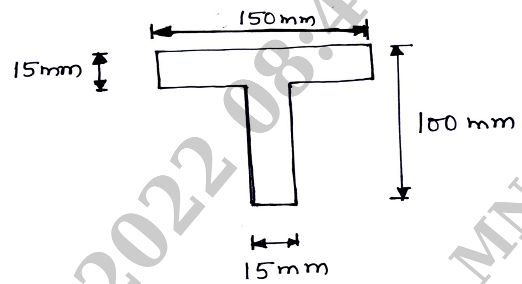

Fig. Q6(b)

Module-4

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

b. A solid circular shaft is subjected to a bending moment of 10kN-m and a torque of 15kN-m. The yield stress of the material in simple tension is 250MPa and E = 200GPa. If factor of safety is 3. Determine the maximum diameter of the shaft using Maximum Principal Stress theory and Maximum Shear Stress theory. **(10 Marks)**

OR

8 a. Write a note on :
i) Maximum Principal Stress theory ii) Maximum Shear Stress theory. **(08 Marks)**

b. A solid circular shaft is required to transmit 300kW at 120 rpm. The shear stress in the material is not to exceed $80 N/mm^2$. Find the diameter required. If the shaft is replaced by a hollow one whose internal diameter is 0.6 times its external diameter. The length material and maximum shear stress being same. Calculate the percentage saving in weight, that could be obtained. **(12 Marks)**

Module-5

9 a. Explain Castigliano's theorem I with its applications and Castigliano's theorem II. **(10 Marks)**

b. A hallow cast iron column whose outside diameter is 200mm and thickness of 20mm is 4.5m long and is fixed at both ends. Calculate the safe load by Rankine formula using factor of safety 2.5. Find the ratio of Euler's to Rankine's loads. Take $E = 1 \times 10^5 N/mm^2$ and Rankine constant = $\frac{1}{1600}$ for both ends fixed and $\sigma_c = 550 N/mm^2$. **(10 Marks)**

OR

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

b. Calculate the strain energy stored in a bar shown in Fig. Q10(b), subjected to a gradually applied axial load of 80kN. Compare this value with what obtained in uniform bar of same length and having the same volume, when subjected to the same load. $E = 2 \times 10^5 N/mm^2$. **(10 Marks)**

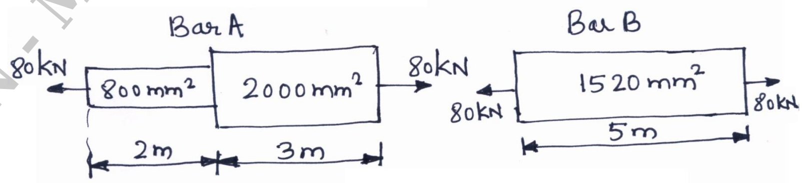

Fig. Q10(b)

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18ME33

Third Semester B.E. Degree Examination, Feb./Mar. 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 charts and 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. Distinguish between:
(i) Macroscopic and microscopic approaches
(ii) Intensive and extensive properties **(10 Marks)**

b. Define the following terms:
(i) System (ii) State (iii) Property
(iv) Quasi-static process (v) Thermodynamic cycle **(10 Marks)**

OR

2 a. Define Thermodynamic Equilibrium. Also explain Mechanical, Chemical and Thermal equilibrium. **(10 Marks)**

b. A constant volume gas thermometer containing helium gives readings of gas pressure 'P' as 1000 and 1366 mm of mercury at ice point and steam point respectively. Assuming a linear relationship of the form $t = a + bP$, express the gas thermometer celsius temperature 't' in terms of gas pressure P. What is the temperature recorded by the thermometer, when it registers a pressure of 1074 mm of mercury? **(10 Marks)**

Module-2

3 a. Compare work and heat. **(10 Marks)**

b. A fluid contained in a horizontal cylinder fitted with a frictionless leak proof piston is continuously agitated by a stirrer passing through the cylinder cover. The diameter of the cylinder is 40 cm and piston is held against the fluid due to atmospheric pressure equal to 100 kPa. The stirrer turns 7000 revolutions with an average torque of 1 Nm. If the piston slowly moves outwards by 50 cm determine the network transfer to the system. **(10 Marks)**

OR

4 a. With a neat diagram, explain Joule's experiments. Also state the first law of thermodynamics. **(10 Marks)**

b. A centrifugal compressor delivers 20 kg/min of air. Air enters the compressor of 5 m/s, 100 kPa and leaves at 9 m/s, 600 kPa. Heat lost to the surroundings during this process is 10 kJ/s. If the increase in enthalpy of the fluid is 180 kJ/kg and inlet and outlet specific volume of air are 0.5 m^3/kg and 0.16 m^3/kg respectively, determine the power of the motor to drive the compressor. Also calculate the ratio of inlet pipe diameter to the outlet pipe diameter. Assume zero elevation difference. **(10 Marks)**

Module-3

5 a. Describe the limitations of first law of thermodynamics. Also explain Kelvin-Plank and Clausius statements of second law of thermodynamics with representative diagrams. **(10 Marks)**

b. Two Carnot engines A and B are connected in series between two thermal reservoirs maintained at 1000 K and 100 K respectively. Engine A receives 1680 kJ of heat from high temperature reservoir and rejects heat to the Carnot engine B. Engine B takes in heat rejected by engine A and reject heat to the low temperature reservoir. If engines A and B have equal thermal efficiencies, determine:
(i) The heat rejected by engine B.
(ii) Temperature at which heat is rejected by engine A.
(iii) Work done by engine A and B. **(10 Marks)**

OR

6 a. Define entropy and explain the principle of increase of entropy. **(10 Marks)**
b. A closed system contains air at pressure 1 bar, temperature 290 K and volume 0.02 m^3. This system undergoes a thermodynamic cycle consisting of the following three process:
Process 1-2: Constant volume heat addition till pressure becomes 4 bar.
Process 2-3: constant pressure cooling.
Process 3-1: Isothermal heating to initial state. Evaluate the change in entropy for each process. Take C_V = 0.718 kJ/kgK, R = 287 J/kgK. Also represent the cycle on T-S and P-V plot. **(10 Marks)**

Module-4

7 a. Explain the concept of availability and unavailable energy by deducing suitable relevant equation. **(10 Marks)**
b. Superheated steam at 40 bar and 300°C expands to 4 bar and 0.97 dry in a turbine. Determine: (i) Availability (ii) Actual work done (iii) Loss in availability. Assume t_0 = 28°C. **(10 Marks)**

OR

8 a. Draw and explain the salient features of P-T diagram with water as an example. **(08 Marks)**
b. The following data were obtained with a separating and throttling calorimeter pressure in steam main = 15 bar, mass of water drained from the separator = 0.55 kg. Mass of steam condensed after passing through the throttle valve = 4.20 kg. Pressure and temperature after throttling is 1 bar and 120°C. Evaluate the dryness fraction of steam in the main. **(12 Marks)**

Module-5

9 a. Define and explain Dalton's law of partial pressures and Amagat's law of additive volumes. **(10 Marks)**
b. It is required to evacuate hydrogen gas from a 8 m^3 capacity tank form atmospheric pressure of 101.325 kPa to a pressure of 98.125 kPa vacuum at 400 K. Determine the mass of Hydrogen pumped out and pressure in kPa if the temperature of hydrogen left in the tank falls to 290 K. **(10 Marks)**

OR

10 a. Define and explain: (i) Dew Point temperature (ii) Relative humidity (iii) Humidity ratio (iv) Wet Bulb temperature (v) Degree of saturation **(10 Marks)**
b. One kg of carbon monoxide has a volume of 2 m^3 at 80°C. Determine its pressure using:
(i) Ideal gas equation (ii) Vander Waal's equation
Constants for Vander Waal's equations:
a = 147.90 kN-m^4/$(kgmol)^2$ and b = 0.0393 m^3/kgmol. **(10 Marks)**

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CBCS SCHEME

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18ME34

Third Semester B.E. Degree Examination, Feb./Mar. 2022
Material Science

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. State and explain Fick's laws of diffusion. **(08 Marks)**
b. Sketch and explain Edge dislocations. **(04 Marks)**
c. Distinguish between SC, BCC, FCC and HCP with respect to structure, number of atoms, Lattice constant, coordination number and APF. **(08 Marks)**

OR

2 a. Draw stress-strain diagram of Ductile material and explain plastic properties. **(08 Marks)**
b. Derive expressions showing relationship between True Stress versus Engineering Stress and True Strain versus Engineering Strain. **(08 Marks)**
c. Sketch and explain plastic deformation by Twinning. **(04 Marks)**

Module-2

3 a. What is fatigue? Sketch and explain R.R. MOORE fatigue testing showing S-N curves. **(08 Marks)**
b. What is Creep? Explain the stages of creep using creep curve. **(08 Marks)**
c. Explain the application of Gibb's phase rule using binary phase diagram. **(04 Marks)**

OR

4 a. Draw Iron-Cementite diagram. Indicate phases, critical temperatures and explain invariant reactions. **(12 Marks)**
b. Briefly explain the effect of alloying elements on Iron-Carbon diagram. **(04 Marks)**
c. What is Solidification? Explain the mechanism of Solidification. **(04 Marks)**

Module-3

5 a. What is heat treatment? Mention the classification. **(06 Marks)**
b. Sketch and explain TTT diagram. **(06 Marks)**
c. Differentiate between hardness and hardenability. Sketch and explain 'JOMINY END QUENCH' test to determine hardenability. **(08 Marks)**

OR

6 a. Sketch and explain Annealing heat treatment process. **(06 Marks)**
b. What is Age hardening? Explain the Age hardening of Aℓ-Cu alloys using phase diagram. **(06 Marks)**
c. Explain the composition, properties and applications of Gray Cast Iron, White Cast Iron, Malleable iron and S.G. Iron. **(08 Marks)**

Module-4

7 a. What are composites? How do you classify them? **(06 Marks)**
b. Sketch and explain the fabrication of MMC's using stir casting process. **(08 Marks)**
c. Explain the functions of matrix and reinforcement. **(06 Marks)**

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OR

8	a.	Derive an expression for Elastic modulus of the composite under iso-strain condition.	**(06 Marks)**
	b.	List advantages, disadvantages and applications of composite materials.	**(08 Marks)**
	c.	Sketch and explain the fabrication of CMC's using "slurry infiltration process".	**(06 Marks)**

Module-5

9	a.	Briefly explain Thermoplastics, Thermosets and Elastomers.	**(06 Marks)**
	b.	Sketch and explain the processing of plastics by "injection molding".	**(08 Marks)**
	c.	What are ceramics? Mention the classification.	**(06 Marks)**

OR

10	a.	Briefly explain optical and thermal materials.	**(06 Marks)**
	b.	What are smart materials? Explain briefly the types of smart materials.	**(08 Marks)**
	c.	Write a brief note on Non-Destructive methods used for residual life assessment.	**(06 Marks)**

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18ME35B/18MEB305

Third Semester B.E. Degree Examination, Feb./Mar. 2022
Metal Casting and Welding

Time: 3 hrs. Max. Marks: 100

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

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

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Module-1

1 a. Explain basic steps involved in a Sand Casting Process. **(10 Marks)**

b. What is pattern? List the types and explain the following with neat sketches:
(i) Match plate pattern
(ii) Two piece pattern **(10 Marks)**

OR

2 a. Explain different steps involved in shell molding process with a neat sketch. **(08 Marks)**

b. What are ingredients of molding sand? Explain briefly. **(06 Marks)**

c. What is a core? Explain various types of cores used in casting process. **(06 Marks)**

Module-2

3 a. Classify melting furnaces. Explain any one of them with a neat sketch. **(10 Marks)**

b. What are the zones in cupola? With a neat sketch, explain cupola furnace. **(10 Marks)**

OR

4 a. Describe with a neat sketch, Thixo casting process and mention its advantages, limitations and applications. **(10 Marks)**

b. Explain the hot chamber die casting process with a neat sketch. **(10 Marks)**

Module-3

5 a. What is Nucleation? Explain Homogeneous nucleation and Hetrogeneous nucleation with sketches. **(10 Marks)**

b. Explain various defects in sand casting process with its causes and remedies. **(10 Marks)**

OR

6 a. Explain the melting process of aluminum using stir casting setup with a neat sketch. **(10 Marks)**

b. What is degasification in liquid metals? Explain the methods of degasification with neat sketches. **(10 Marks)**

Module-4

7 a. Sketch and explain Metal Inert gas welding and its advantages, limitations. **(10 Marks)**

b. What is the principle of resistance welding? Explain: (i) Spot welding (ii) Laser welding, with neat sketches. **(10 Marks)**

OR

8 a. With a neat sketch, explain electron beam welding and write advantages, disadvantages and applications. **(10 Marks)**
b. Differentiate between metal arc welding and oxy-acetylene gas welding. **(10 Marks)**

Module-5

9 a. With neat sketch, explain Heat Affected Zone (HAZ) and its various zones. **(10 Marks)**
b. Explain various methods used for inspection of casting and welding. **(10 Marks)**

OR

10 a. Differentiate between soldering and brazing. **(06 Marks)**
b. What are welding defects? Explain the methods to detect the welding defects. **(10 Marks)**
c. What are the functions of electrode coatings in metal arc welding electrode? **(04 Marks)**

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18ME36A/18MEA306/18MA36

Third Semester B.E. Degree Examination, Feb./Mar. 2022

COMPUTER AIDED MACHINE DRAWING

Time: 3 Hours Max. Marks: 100

Note: 1. Answer any ONE question from each of the parts A, B and C.
2. Use **First angle** projections only.
3. If any data is missing it may be suitably assumed and mentioned.
4. All the calculations should be on the answer sheet supplied.
5. All the dimensions are in mm.
6. Drawing instruments may or may not be used for sketching.
7. Part C assembly view should be in 3-D and other views in 2-D.

Part – A

1. Draw (i) the sectional view from the front and (ii) the view from above of a bearing bracket shown in Fig. 1 **25 Marks**

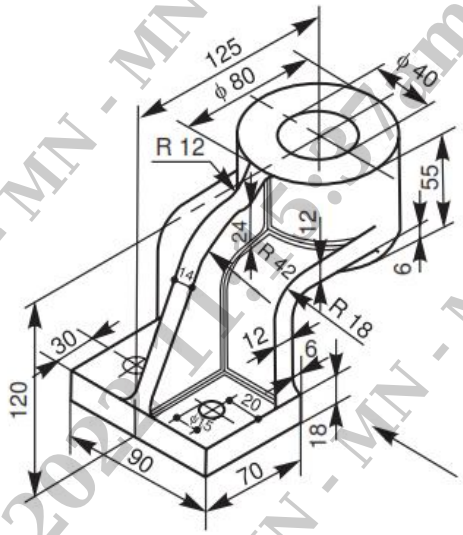

Figure. 1: Bearing bracket

2. Draw two views of a square headed bolt and nut (assembly) for a 25mm diameter bolt. Take the length of the bolt equal to 100mm **25 Marks**

Part – B

3. Draw the following view of a SOCKET and SPIGOT COTTER JOINT used to joining two rods of diameter 30mm (a) Sectional front view (b) A view looking from socket end. **25 Marks**

4. Draw sectional front view and side view of a Universal Coupling to connect two rods of diameter 25mm, indicate all dimensions. **25 Marks**

Part – C

5. Figure 2 shows the details of a screw jack. Assemble the parts of the screw jack and show the following views.

a. Half sectional front view showing the right half in section.

b. Top view. **50 Marks**

6. Figure 3 shows the part drawing of a tail stock. Assemble the tail stock and show the following views.

a. Sectional front view showing the top spindle portion in section.

b. Left profile view. **50 Marks**

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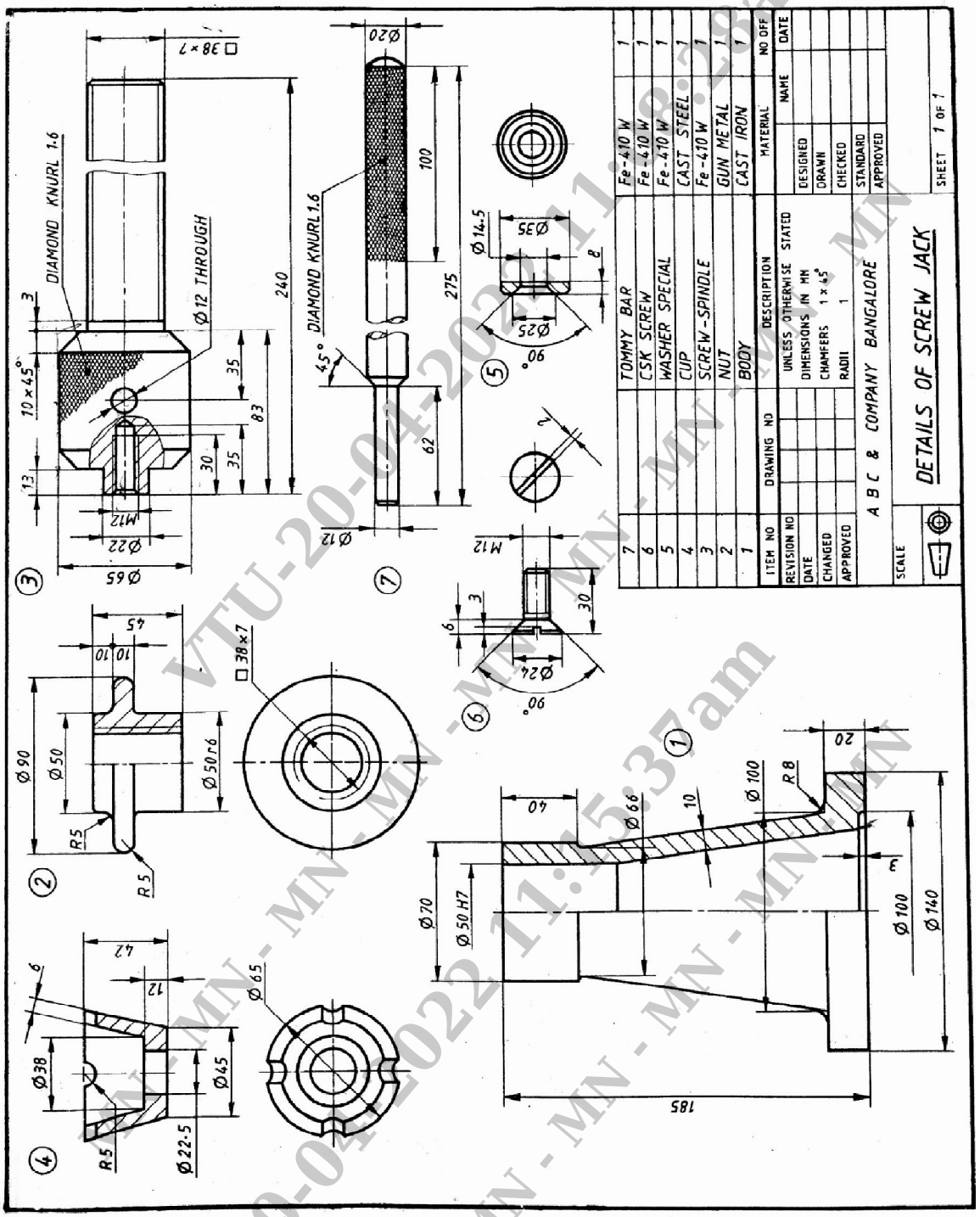

Figure 2: Details of screw jack

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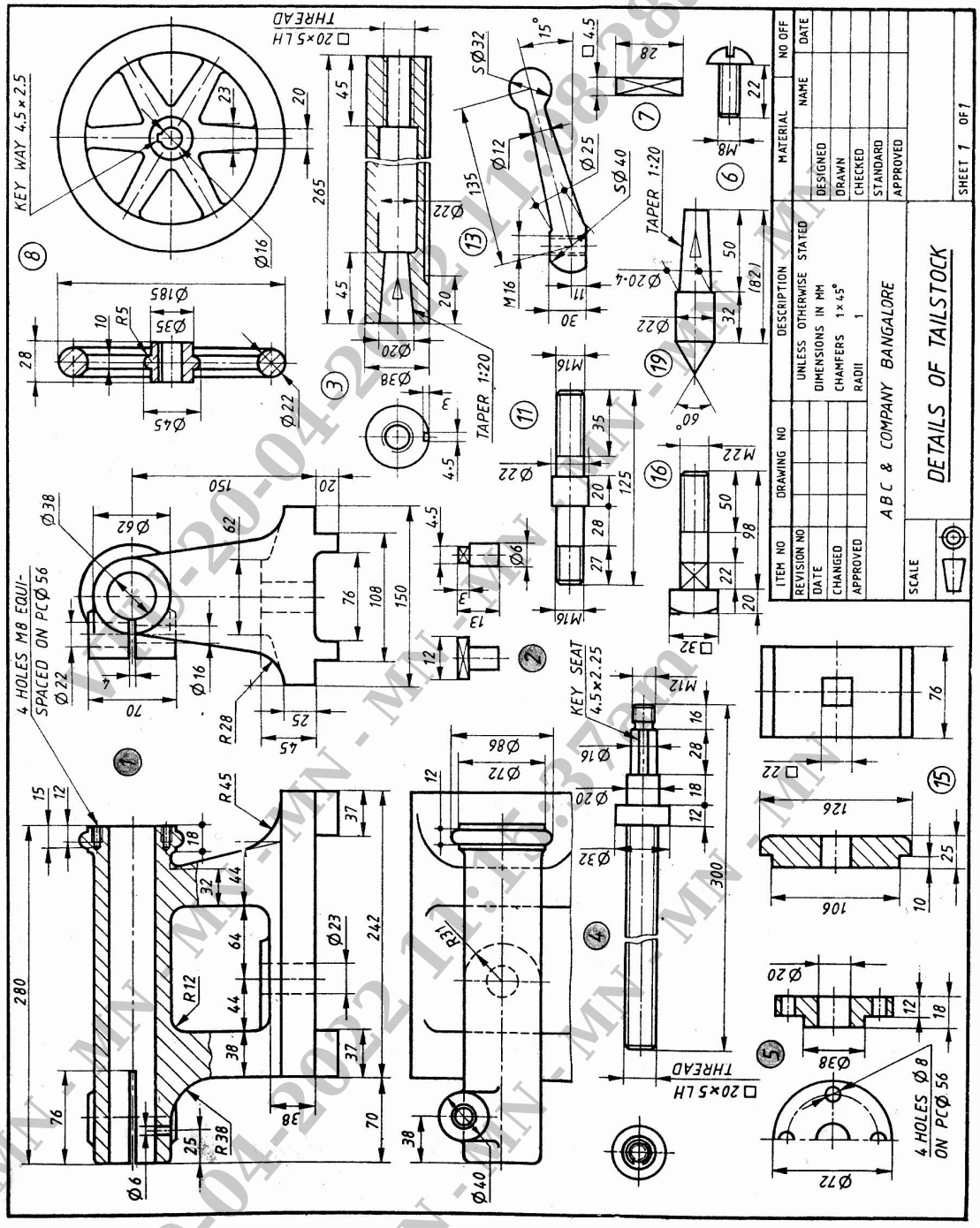

Figure 3 : Details of a tail stock.

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18ME36A/18MEA306/18MA36

Third Semester B.E. Degree Examination, Feb./Mar. 2022

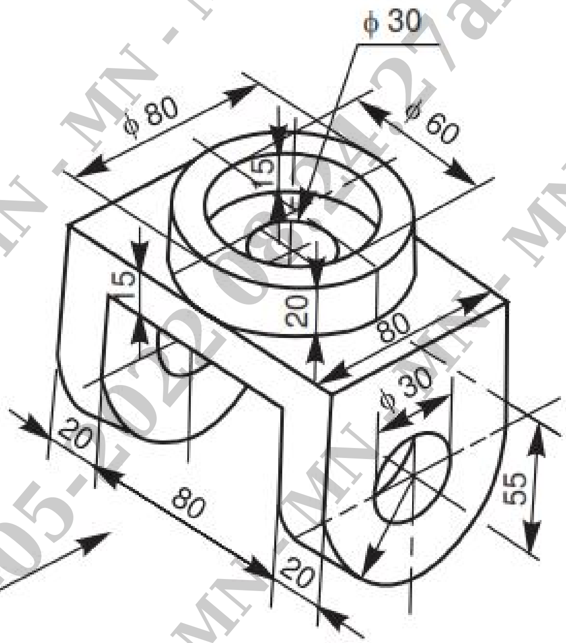
COMPUTER AIDED MACHINE DRAWING

Time: 3 Hours Max. Marks: 100

Note: 1. Answer any ONE question from each of the parts A, B and C.
2. Use **First angle** projections only.
3. If any data is missing it may be suitably assumed and mentioned.
4. All the calculations should be on the answer sheet supplied.
5. All the dimensions are in mm.
6. Drawing instruments may or may not be used for sketching.
7. Part C assembly view should be in 3-D and other views in 2-D.

Part – A

1. Draw (i) the sectional view from the front, (ii) the view from above and (iii) the view from the left of a fork shown in Fig. 1



25 Marks

Fig. 1: Fork

2. With a pitch of 45mm, Draw the following to indicate conventional representation of (a) BSW thread and (b) Acme threads show at least 3 threads in a section.

25 Marks

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Part – B

3. Draw the following view of a SOCKET and SPIGOT COTTER JOINT used to joining two rods of diameter 30mm (a) Sectional front view (b) A view looking from socket end. **25 Marks**
4. Draw sectional front view and side view of a split muff Coupling to connect two rods of diameter 25mm, indicate all dimensions. **25 Marks**

Part – C

5. Figure 1 shows the details of a Plummer block. Assemble the parts of the Plummer block and show the following views.
   a. Half sectional front view showing the right half in section.
   b. Top view. **50 Marks**

6. Figure 2 shows the part drawing of a tail stock. Assemble the tail stock and show the following views.
   a. Sectional front view showing the top spindle portion in section.
   b. Left profile view. **50 Marks**

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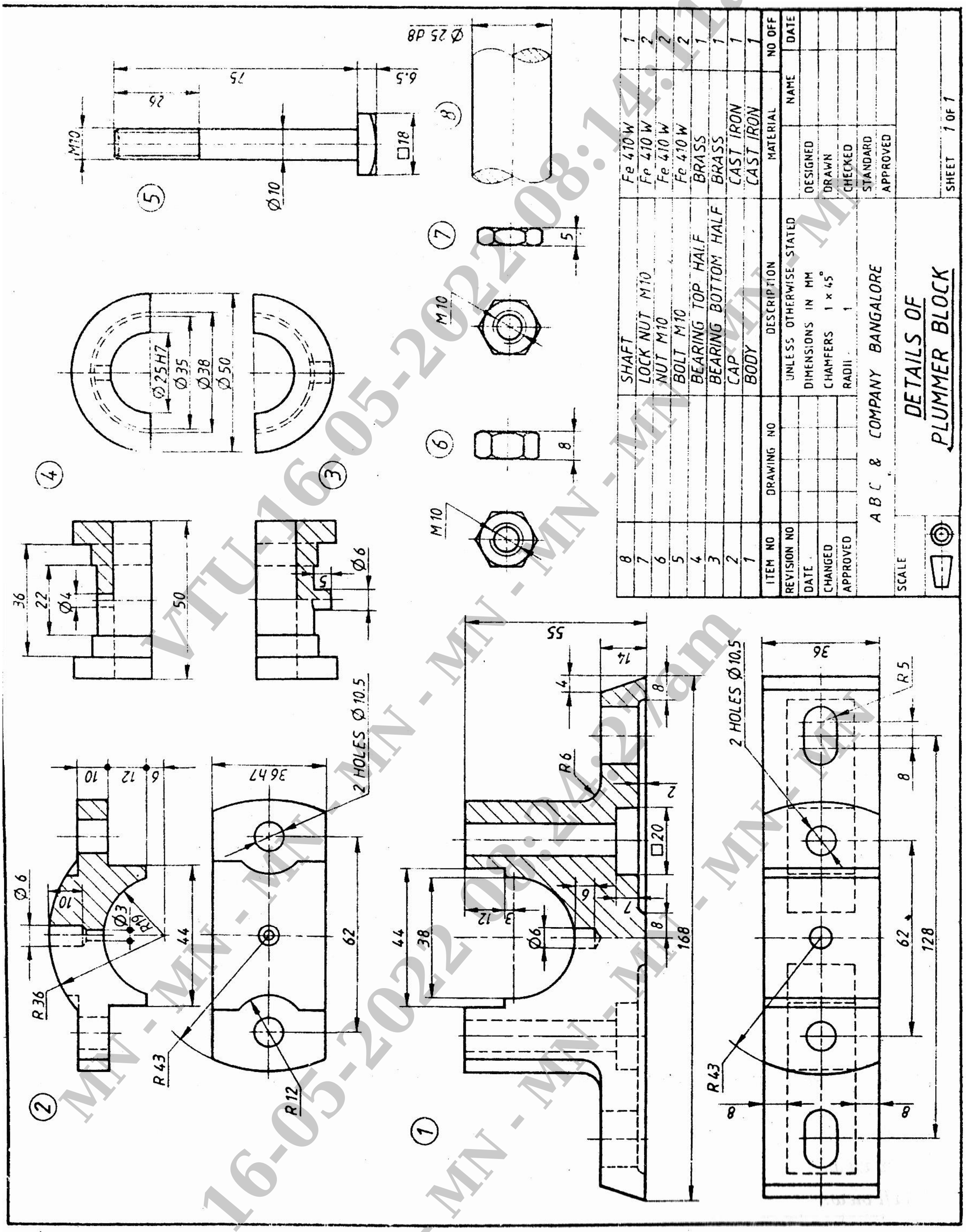

Figure 1 Details of Plummer block.

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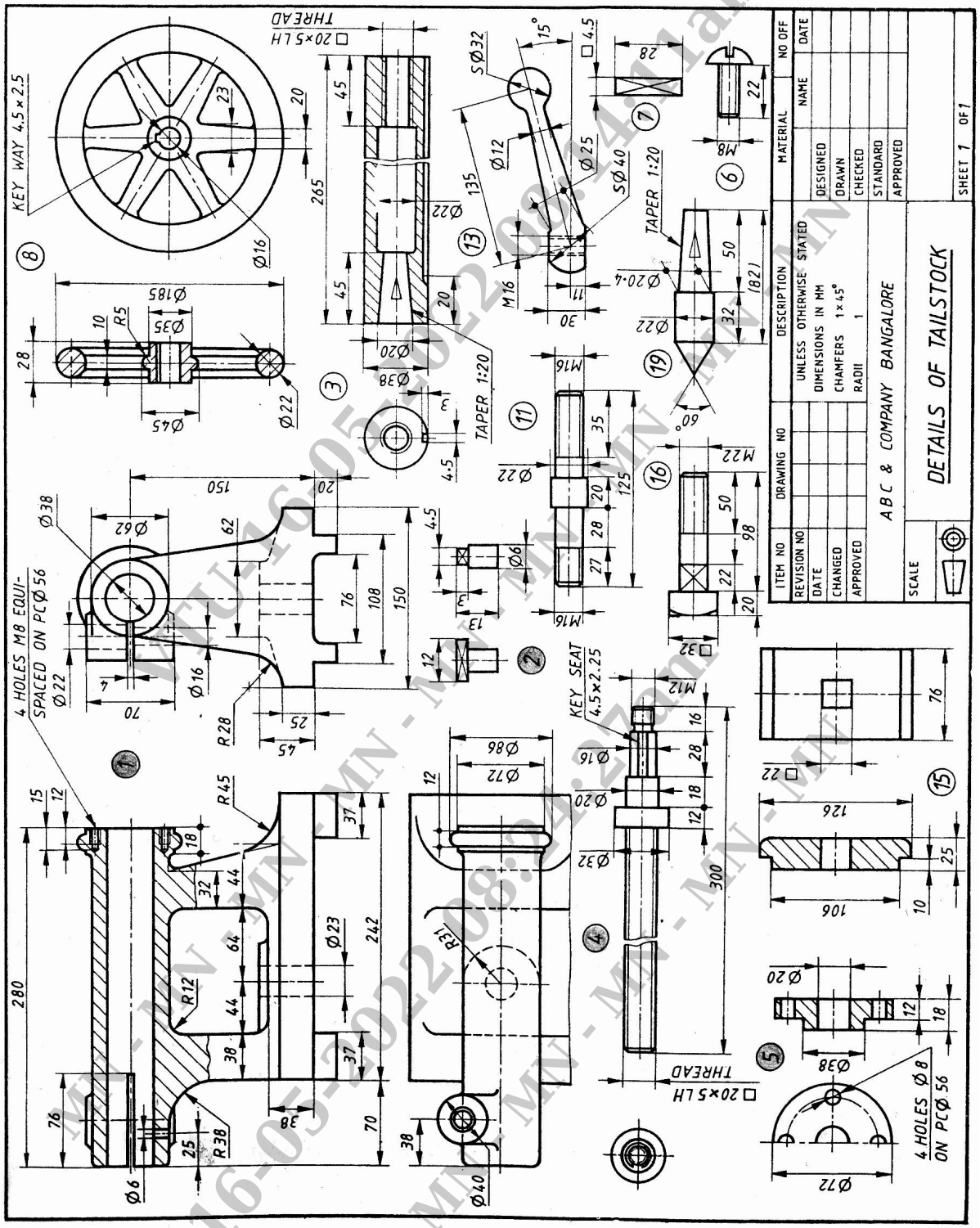

Figure 2 Details of a tail stock

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18ME36A/18MEA306/18MA36

Third Semester B.E. Degree Examination, Feb./Mar. 2022

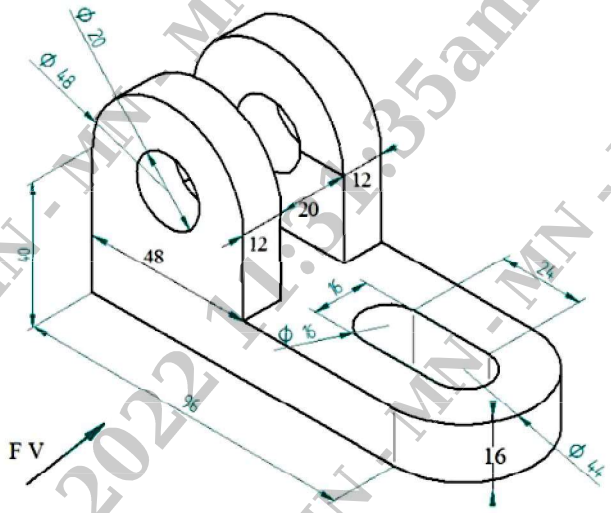
COMPUTER AIDED MACHINE DRAWING

Time: 3 Hours Max. Marks: 100

Note: 1. Answer any ONE question from each of the parts A, B and C.
2. Use **First angle** projections only.
3. If any data is missing it may be suitably assumed and mentioned.
4. All the calculations should be on the answer sheet supplied.
5. All the dimensions are in mm.
6. Drawing instruments may or may not be used for sketching.
7. Part C assembly view should be in 3-D and other views in 2-D.

Part – A

1. Using First Angle Projection, Draw the Orthographic Views of the object shown in figure below.



(25 Marks)

2. A square pyramid side of base 40mm and altitude 60mm has its base on HP with an edge of base inclined at 30^0 to VP, passing through one of the extreme base corner and $3/4^{th}$ distance from the apex of the pyramid. Draw the sectional top view and true shape of section **(25 Marks)**

Part – B

3. Draw the sectional front and top view of knuckle joint for diameter 20mm. **(25 Marks)**

4. Draw sectional front view and side view of a split Muff coupling to connect two rods of diameter 20mm, indicate all dimensions. **(25 Marks)**

Part – C

5. Figure 1 shows the details of a "SCREW JACK". Assemble the parts and show the following views.

a. Half sectional front view showing the right half in section.
b. Top view. **(50 Marks)**

6. Figure 2 shows the part drawing of a "TAIL-STOCK". Assemble the Parts and show the following views.

a. Sectional front view
b. Top view. **(50 Marks)**

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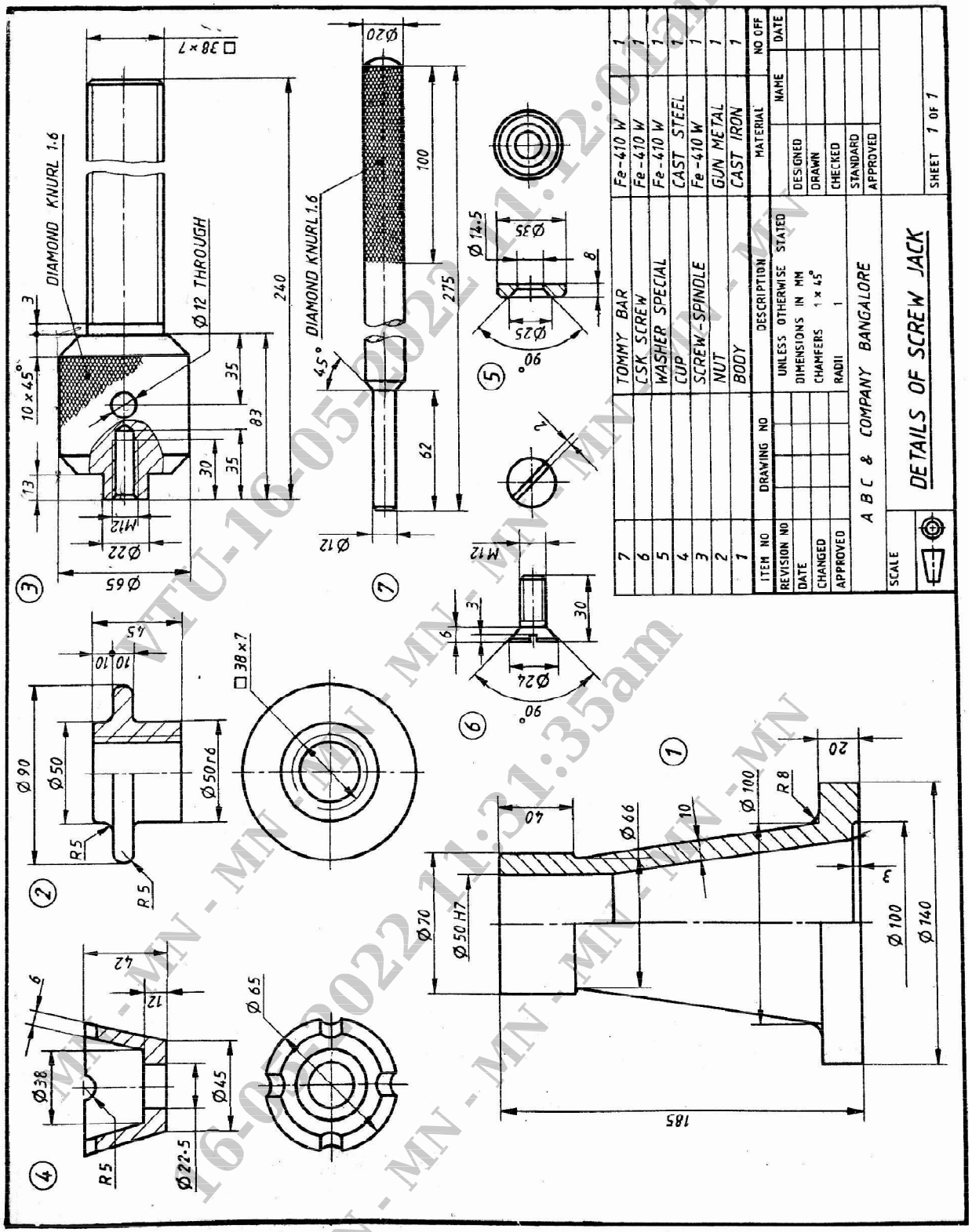

Figure 1: Details of Screw jack

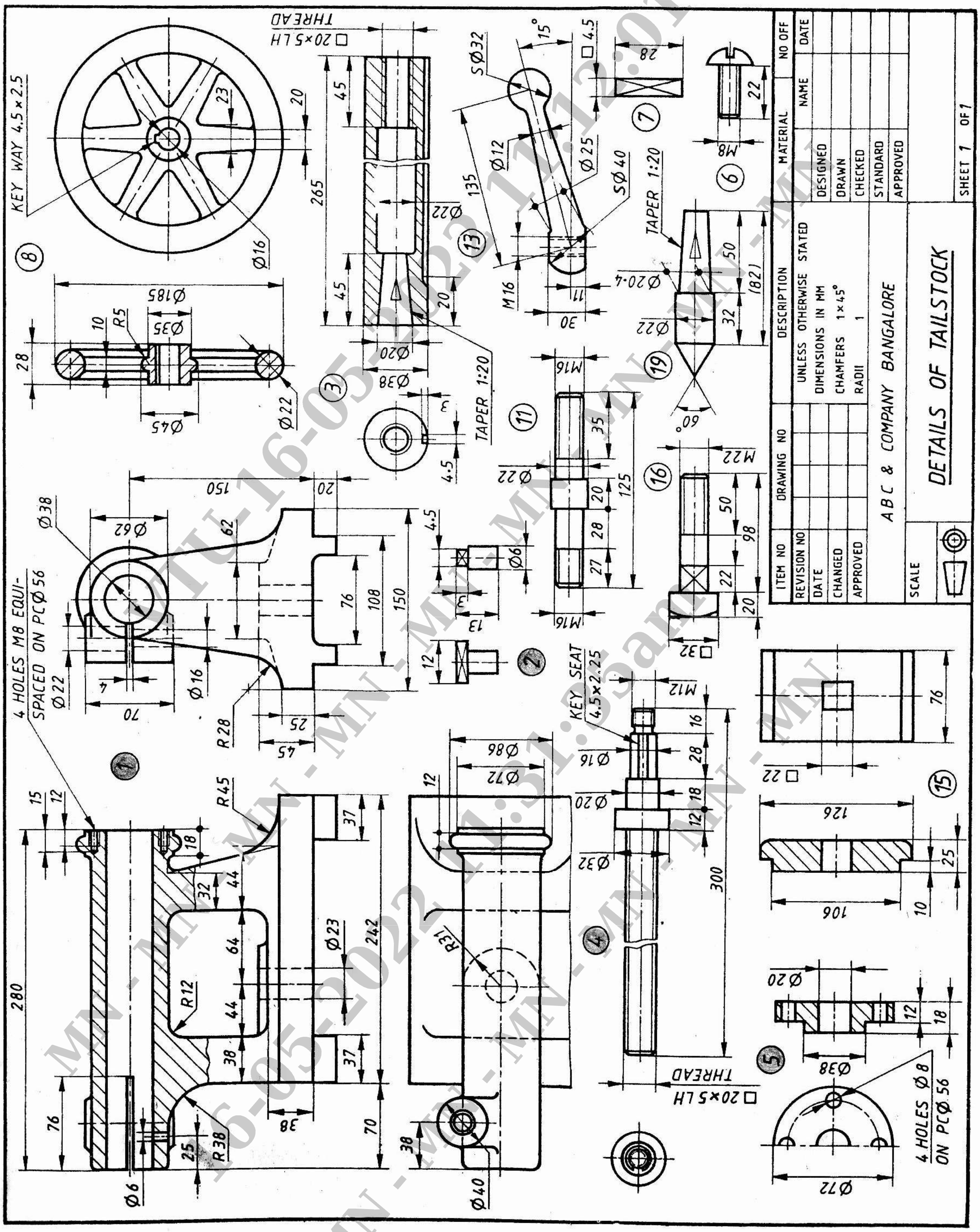

Figure 2: Details of tailstock

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18ME51

Fifth Semester B.E. Degree Examination, Feb./Mar. 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 Discrete compound interest factors handbook tables is 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. Define management and explain the function to be performed by managers to at air the set goals. **(10 Marks)**

b. Define planning and briefly discuss the steps involved in planning. **(10 Marks)**

OR

2 a. Discuss the functional areas of management. **(12 Marks)**

b. Explain the steps involved in rotational decision making. **(08 Marks)**

Module-2

3 a. Write a note on principle of organization. **(12 Marks)**

b. Explain Marsha's need hierarchy theory in brief. **(08 Marks)**

OR

4 a. Explain the terms MBO and MBE. **(10 Marks)**

b. What is controlling and explain the steps in control process. **(10 Marks)**

Module-3

5 a. Explain the law of demand and law of supply with suitable examples. **(08 Marks)**

b. Explain the 72 rule of present worth. **(04 Marks)**

c. A man wishes to have a future sum of Rs.50 lakhs for his daughters education for 10 years from now. What is the single payment that he should deposit so that he gets the desired amount after 10 years. The bank offers 12% rate of interest, compounded annually. **(08 Marks)**

OR

6 a. Define engineering economics and briefly explain microeconomics and macroeconomics. **(10 Marks)**

b. A man is planning to build his house. He plans to invest Rs.40,000 per year for the next 10 years. The bank offers 12% interest rate compounded annually. Find the maturity value of his account after 10 years. **(10 Marks)**

Module-4

7 a. Explain future worth method of comparison. **(06 Marks)**

b. Explain IRR (Internal Rate of Return) and MARR (Minimum Acceptable rate of Return). **(06 Marks)**

c. Following are the estimates of two alternate investment made in two different machines in an industry. Find out which machine has the fastest payback period.

	Particulars	Machine A	Machine B
1	Initial investment	30,000	42,000
2	Annual receipts	20,000	26,000
3	Annual expenditures	5,500	7,000
4	Economics life	4 years	4 years

(08 Marks)

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OR

8 a. Rs.10 crores was generated by the management of an engineering college for the construction of its new mechanical science block. Annual maintenance of the block is estimated to be Rs.10 lakh. In addition Rs.12 lakh will be needed every 10 years for painting and Hoyer repairs. If the budget granted has to take care of perpetual maintenance, how much of the amount can be used for initial construction costs? Deposited funds can earn 6% rate of interest compounded annually. Assume that taxes and inflation do not come into picture. **(12 Marks)**

b. What are the various method of comparing the worthiness of engineering projects. Explain any one method. **(08 Marks)**

Module-5

9 a. What are the various components/causes of depreciation? **(05 Marks)**

b. Explain how selling price is fixed for a product and show all the components of cost. **(05 Marks)**

c. An investment of Rs.8,000 is made by Suresh for his manually operated pen machine. Its salvage value after 5 years is Rs.1000. Find straight line depreciation expense? Find the book value at the end for each year and also. Find the depreciation fund collected at the end of 4th year. **(10 Marks)**

OR

10 a. Differentiate between estimation and testing. **(05 Marks)**

b. Explain briefly the objectives of costing. **(05 Marks)**

c. A cost iron component, as shown in figure below is to be manufactured. Estimate the selling price per piece from the following data :

Density of material = 7.2gm/cc
Cost of molten metal = Rs. 20/kg
Process scrap = 20% of net weight
Scrap return value = Rs.6/kg
Administrative overheads = Rs.30/hour
Sales overheads = 20% of factory cost
Profit = 20% of factory cost
Other expenditures are as follow :

Operation	Time/piece minutes	Labour cost per hour is Rs.	Shot overheads Rs./hour
Moulding and paring	15	20	60
Shot blasting	5	10	40
Fettling and inspections	6	10	40

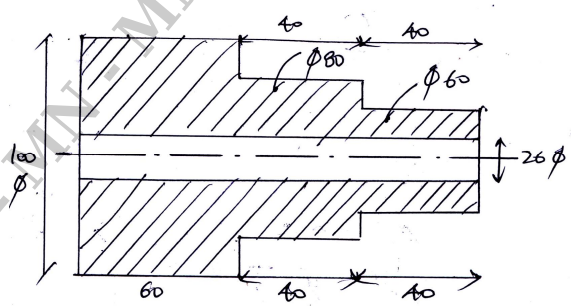

Fig.Q10(c) All dimensions are in 'mm' **(10 Marks)**

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18ME52

Fifth Semester B.E. Degree Examination, Feb./Mar. 2022
Design of Machine Elements – I

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of design data handbook is 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 the factors which influence the selection of engineering materials. **(05 Marks)**

b. Explain codes and standards. List any four organizations who have established specifications for standards and codes. **(05 Marks)**

c. A machine member 60mm diameter is subjected to combined loading as shown in Fig.Q1(c). Determine the maximum principal stress and maximum shear stress at point P.

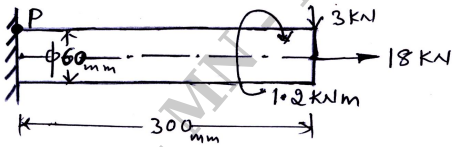

Fig.Q1(c) **(10 Marks)**

OR

2 a. Explain even and uneven materials with the help of Mohr's circles. **(04 Marks)**

b. State and explain the following theories of failure:
(i) Maximum normal stress theory (ii) Maximum shear stress theory
(iii) Distortion energy theory (Hencky Von-Mises theory) **(06 Marks)**

c. A flat bar as shown in Fig.Q2(c) is subjected to an axial pull of 100 kN. Calculate its thickness if allowable tensile stress is 180 MPa.

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

Module-2

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

b. A steel rod 1.5m long has to resist longitudinally an impact of 2.5 kN falling under gravity at a velocity of 0.9925 m/s. The maximum computed stress is to be limited to 150 MPa. Determine the diameter of the round rod. Take E = 210 GPa. **(07 Marks)**

c. A beam of I-section 250mm depth has a moment of inertia of 60×10^6 mm^4. It is simply supported at the ends at a distance of 3m apart. A weight of 3 kN falls at its middle from an unknown height. Determine the safe height 'h' taking the allowable stress as 90 MPa. Take E = 210 GPa. **(08 Marks)**

OR

4 a. Obtain Soderberg's relation for a member subjected to fatigue loading. **(05 Marks)**

b. A steel connecting rod of rectangular cross-section having depth twice that of the width is subjected to a completely reversed axial load of 18 kN. The endurance stress is 300 MPa and yield stress is 420 MPa. Determine suitable cross-sectional dimensions of the connecting rod. Take size factor = 0.9, Load factor = 0.7, Surface factor = 0.85, Stress concentration factor = 1.5, Notch sensitivity = 1. Factor of safety = 1.8. Neglect column effect. **(07 Marks)**

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c. A steel rod (σ_y = 400.1 MPa and σ_{-1} = 345.2 MPa) of circular cross-section shown in Fig.Q4(c) is subjected to load varying from 3F to F. Determine the value of F. Use a factor of safety 3. Take stress concentration factor = 1.43, q = 1.

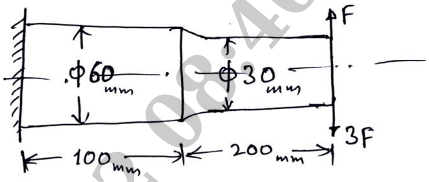

Fig.Q4(c)

Load factor = 1.0 , Size factor = 0.85, Surface factor = 0.85. **(08 Marks)**

Module-3

5 A commercial steel shaft 1m long supported between bearings carries a pulley of diameter 600mm weighing 1 kN located 400mm to the right of the right hand bearing and receives 25 kW at 1000 rpm by a horizontal belt drive. The power from the shaft is transmitted by a spur pinion of 20° pressure angle having pitch circle diameter 200mm to a spur gear such that the tangential force on gear acts vertically upwards. The pinion is keyed to the shaft at a distance of 200mm to the right of the left bearing. Taking the ratio of belt tensions as 3, determine the diameter of the shaft required. Use maximum shear stress theory. Take $\tau_d = 40\ N/mm^2$. **(20 Marks)**

OR

6 a. Select a rectangular sunk key to transmit 9 kW at 300 rpm. The yield stress for the steel used is 310 MPa. Take factor of safety as 2.5 . **(06 Marks)**

b. Design a rigid flange coupling (Un-protected) to transmit 18 kW at 1440 rpm. The allowable shear stress for CI flange is 4 MPa. The shafts, keys and bolts are made of annealed steel having allowable shear stress of 93 MPa. Take allowable crushing stress = 186 MPa for key. Take key way factor η = 0.75 for shaft. **(14 Marks)**

Module-4

7 a. Design a longitudinal joint for a boiler of 2m diameter subjected to a pressure of 1 MPa. The joint is a triple riveted butt joint with equal covers and efficiency of 85%. The pitch of the outer row is twice the pitch of inner rows. The arrangement is of chain type. Take allowable stress in tension = 117.67 N/mm^2, in shear = 70.6 N/mm^2 and in crushing = 176.50 N/mm^2. Take coefficient $k_1 = 6$ and corrosion allowance of 2 mm. **(12 Marks)**

b. A bracket attached to a vertical column by means of four identical rivets, is subjected to an eccentric force of 25 kN as shown in Fig.Q7(b). Determine the diameter of rivets, if the permissible shear stress is 60 N/mm^2.

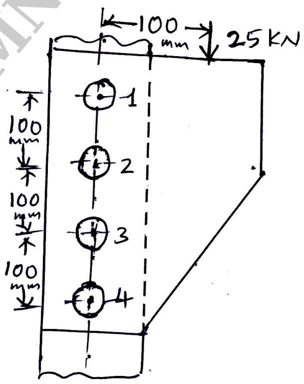

Fig.Q7(b) **(08 Marks)**

OR

8 a. A welded connection as shown in Fig.Q8(a) is subjected to an eccentric force of 60 kN in the plane of the welds. Determine the size of the welds, if the permissible shear stress for the weld is 100 N/mm^2. Assume static conditions.

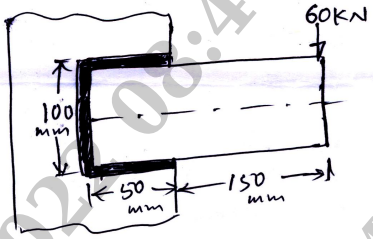

Fig.Q8(a) **(12 Marks)**

b. Determine the load carrying capacity of a welded joint loaded as shown in Fig.Q8(b). The allowable shear stress for 10mm weld used is 50 MPa.

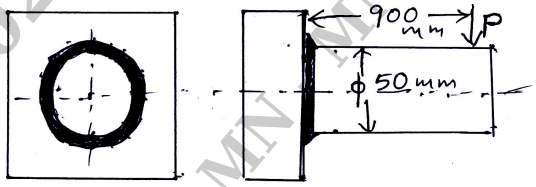

Fig.Q8(b) **(08 Marks)**

Module-5

9 a. It is required to design a cottor joint to connect two steel rods of equal diameter. Each rod is subjected to axial tensile force of 50 kN. Design the joint and specify main dimensions. Take permissible stresses for rods in tension = 67 N/mm^2. Crushing = 134 N/mm^2 and for cottor in tension = 100 N/mm^2. **(08 Marks)**

b. Explain self-locking in power screws. **(02 Marks)**

c. A bracket is bolted as shown in Fig.Q9(c). All the bolts are of same size and are made of steel having allowable tensile stress of 90 MPa and allowable shear stress of 52 MPa. Determine the size of the bolts to be used.

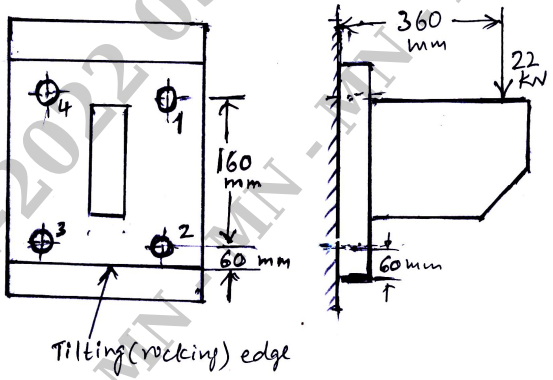

Fig.Q9(c) **(10 Marks)**

OR

10 a. Obtain an expression for torque required to raise the load in power screws. **(08 Marks)**

b. Enumerate four typical applications of knuckle joint. **(02 Marks)**

c. A machine weighing 20 kN is to be raised by a single start square threaded screw rod of 50mm diameter, 8mm pitch screw jack at a maximum speed of 6 m/minute. If the coefficient of friction for threads is 0.2, determine the power required to raise (lift) the machine. The inside and outside diameters of the thrust collar are 30 and 60mm respectively. The coefficient of friction for collar is 0.1. **(10 Marks)**

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18ME53

Fifth Semester B.E. Degree Examination, Feb./Mar. 2022
Dynamics 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.

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Module-1

1 a. Define static equilibrium. State two conditions for equilibrium **(04 Marks)**

b. In a slider crank mechanism, the force applied to the piston is 1 kN, when the crank is at 60° from IDC. The length of the crank is 100mm and connecting rod is 300 mm. Calculate the driving torque T_2 on the crank to attain equilibrium. **(16 Marks)**

OR

2 The dimensions of a four-link mechanism are AB = 500mm, BC = 660mm, CD = 560mm and AD = 1000mm. The link AB has an angular velocity of 10.5 rad/sec counterclockwise and an angular retardation of 26 rad/sec^2 at the instant when it makes an angle of 60° with AD, the fixed link. The mass of the links BC and CD is 4.2 kg/m length. The link AB has a mass of 3.54 kg, the center of which lies at 200mm from A and a moment of inertia of 88,500 kg-mm^2. Neglecting gravity and friction effects, determine the instantaneous value of the drive torque required to be applied on AB to overcome the inertia forces. **(20 Marks)**

Module-2

3 a. Justify the need of balancing of rotating parts for high speed engines. What is the difference between static and dynamic balancing? **(04 Marks)**

b. A shaft carries four masses A, B, C and D placed in parallel planes perpendicular to the shaft axis and in this order along the shaft. The masses B and C are 40 kg and 28 kg and both are at 160mm radius. While the masses in planes A and D are at 200 mm radius. Angle between B and C is 100°, B and A is 190°, both angles being measured in the same sense. Planes A and B are 250mm apart, B and C are 500mm apart. If the shaft is to be in complete balance, determine (i) Masses in planes A and D (ii) Distance between planes C and D (iii) Angular position of mass D. **(16 Marks)**

OR

4 The pistons of a 4 cylinder vertical inline engine reach their uppermost position at 90° interval in order of their axial position. Pitch of cylinder is 0.35m, crank radius is 0.12m, length of connecting rod is 0.42m. The engine runs at 600rpm. If the reciprocating parts of each engine has a mass of 2.5kg, find the unbalanced primary and secondary forces and couples. Take central plane of engine as reference plane. **(20 Marks)**

Module-3

5 a. Define the following terms with reference to governors:
(i) Sensitiveness (ii) Hunting (iii) Isochronism (iv) Governor power **(08 Marks)**

b. Each arm of a porter governor is 300mm long and is pivoted on the axis of the governor. Each ball has a mass of 6 kg and the mass of sleeve is 18kg, the radius of rotation of ball is 200mm when the governor begins to lift and 250mm when the speed is maximum. Determine the maximum and minimum speed and range of speed of the governor. **(12 Marks)**

OR

6 a. Define gyroscopic effect. With usual notations and diagram, derive an expression for the gyroscopic couple produced by a rotating disc. **(08 Marks)**

b. An aeroplane has engine speed 2000rpm clockwise when viewed from rear. It is flying at 240 kmph speed and turns towards lift and completes a quarter circle of 60m radius. The mass of the rotor engine and the propeller of the plane is 450kg with a radius of gyration of 320 mm. Determine the gyration couple on the aircraft and its effect. In what way the effect changes when the (i) Aeroplane turns towards right (ii) Engine rotates clockwise when viewed from the front (nose end) and the aeroplane turns right. **(12 Marks)**

Module-4

7 a. Define the following terms:
(i) Simple harmonic motion (ii) Natural frequency (iii) Resonance
(iv) Forces vibration (v) Phase difference **(10 Marks)**

b. Find the natural frequency of the following system shown in Fig.Q7(b). **(10 Marks)**

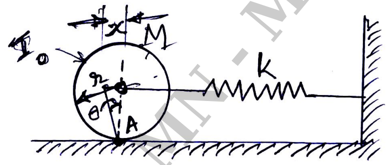

Fig.Q7(b)

OR

8 a. Set up the differential equation for a spring mass damper system and obtain complete solution for the over-damped system. **(10 Marks)**

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

Module-5

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

b. A mass of 100 kg has been mounted on a spring-dash pot system having spring stiffness of 19600 N/m and damping coefficient 100 N-sec/mt. The mass acted upon by a harmonic force of 39N at the undamped natural frequency of the system; find
(i) Amplitude of vibration of the mass
(ii) Phase difference between the force and displacement
(iii) Forces transmissibility ratio. **(10 Marks)**

OR

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

b. A 54 N weight is suspended by a spring with a stiffness of 1100 N/m. It is forced to vibrate by a harmonic force of 5 N. Take viscous damping of 77 N-s/m and find,
(i) Resonant frequency (ii) Amplitude at resonance (iii) Phase angle at resonance.
(iv) Damped natural frequency (v) Frequency at which maximum amplitude of vibration occurs (vi) Maximum or Peak amplitude (vii) Phase angle corresponding to peak amplitude (viii) Speed at which maximum amplitude of vibration would occur. **(10 Marks)**

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18ME54

Fifth Semester B.E. Degree Examination, Feb./Mar.2022
Turbo 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. Differentiate between turbo machine and positive displacement machine under the following aspects (i) Action (ii) Operation (iii) Mechanical features (iv) Efficiency of energy conversion (v) Volumetric efficiency **(10 Marks)**

b. A ¼ scale turbine model is tested under a head of 10 meters. The prototype is required to work under a head of 30 meters and to run at 425 rpm. Estimate the speed of the model if it develops 125 kW and uses 1.1 m^3/sec of water at this speed. Also calculate the power output, discharge of prototype and suggest the type of turbine. **(10 Marks)**

OR

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

b. Show that polytropic efficiency for compressor is given by $\eta_P = \left(\frac{r-1}{r}\right) \times \left(\frac{n}{n-1}\right)$. **(08 Marks)**

c. A turbine has four stages and each stage pressure ratio is 2. The inlet static temperature is 630˚C. The mass flow rate is 30 kg/sec. The overall efficiency is 0.8. Calculate
(i) Polytropic efficiency (ii) The stage efficiency
(iii) The power developed (iv) Reheat factor. **(08 Marks)**

Module-2

3 a. Define degree of reaction and utilization factor. Derive relation between degree of reaction and utilization factor. **(10 Marks)**

b. In an axial flow machine (turbine), the discharge blade angles are 20˚ each for both stator and rotor. The steam speed at the exit of the fixed blade is 140 m/sec. The ratio $\frac{V_f}{U} = 0.7$ at the entry and 0.76 at the exit of the rotor blade. Find the inlet rotor angle, the power developed by the blade ring for a mass flow rate of 2.6 kg/sec and the degree of reaction. **(10 Marks)**

OR

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

b. An inward flow turbine has water inlet angle of 20˚, the water leaves radially, speed of wheel = 350 rpm. Velocity of flow is 4 m/sec. The inner and outer diameter of the turbine are 30 cm and 60 cm respectively. Width of the wheel at inlet is 12 cm. Find the blade angle of power developed. Also what will be the value of R. **(10 Marks)**

Module-3

5 a. What is compounding? Explain (i) Velocity compounding and (ii) Pressure compounding with neat sketches. **(10 Marks)**

b. A single stage impulse turbine has a diameter of 1.5 m and running at 3000 rpm. The nozzle angle is 20°. Speed ratio is 0.45. The ratio of relative velocity at 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 diagram and find the following : (i) Velocity of whirl (ii) Axial thrust (iii) Blade angles (iv) Power developed. **(10 Marks)**

OR

6 a. Derive condition for maximum efficiency of reaction steam turbine and hence prove that $n_{b_{max}} = \frac{2\cos^2 \alpha_1}{1+\cos^2 \alpha_1}$. **(10 Marks)**

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

Module-4

7 a. With a mathematical expression, define the following : (i) Hydraulic efficiency (ii) Mechanical efficiency (iii) Overall efficiency (iv) Volumetric efficiency. **(08 Marks)**

b. Show that the maximum efficiency of Pelton wheel is given by $\eta_{b,max} = \frac{1+C_b \cos\beta_2}{2}$, where C_b = Blade velocity coefficient, β_2 = Bucket angle at its outlet. **(12 Marks)**

OR

8 a. Explain the functioning of a Kaplan turbine, with help of a sectional arrangement diagram. Draw the velocity triangles of Kaplan turbine. **(08 Marks)**

b. The following data is given for a Francis turbine, net head = 70 m, Speed = 600 rpm, Shaft power = 370 kW, $\eta_O = 0.80$, $\eta_h = 0.95$, flow ratio = 0.25, breadth ratio is equal to 0.1, outer diameter of runner is equal to two times inner diameter of the runner. The thickness of vanes occupy 10% circumferential area of the runner. Velocity of flow is constant and discharge is radial at outlet. Determine (i) Guide blade angle (ii) Runner angle at inlet and outlet (iii) Diameter of the runner at inlet and outlet (iv) Width of the wheel at inlet. **(12 Marks)**

Module-5

9 a. Define the following with respect to centrifugal pump, (i) Static head (ii) Cavitation (iii) Priming (iv) Multistage centrifugal pumps. **(08 Marks)**

b. Derive an expression for minimum starting speed for a centrifugal pump. **(06 Marks)**

c. A centrifugal pump discharges 0.15 m^3/s of water against a head of 12.5 m, speed of impeller is 600 rpm. The outer and inner diameter of impeller are 500 mm and 250 mm respectively and the vanes are bent back at 35° to the wheel tangent at exit. If the area of flow remains 0.07 m^2 from inlet to, outlet, find
(i) Manometric efficiency (ii) Vane angle at inlet **(06 Marks)**

OR

10 a. Explain the following with respect centrifugal compressor: (i) Pressure coefficient (ii) Slip factor (iii) Power factor (iv) Surging **(08 Marks)**

b. A centrifugal compressor runs at a speed of 15000 rpm and delivers air at 30 kg/sec. Exit radius is 0.35 m, relative velocity and vane angles at exit are 100 m/s and 75°. Assuming axial inlet, inlet stagnation temperature and pressure as 300 K and 1 bar. Calculate (i) The torque (ii) The power required to drive the compressor. (iii) The ideal head developed (iv) The work done (v) The exit total pressure. Take $C_{P_{air}} = 1.005$ kJ/kg. **(12 Marks)**

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18ME55

Fifth Semester B.E. Degree Examination, Feb./Mar. 2022
Fluid Power Engineering

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.

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Module-1

1 a. Define fluid power system. Sketch and explain the structure of a hydraulic control system. **(08 Marks)**

b. State Pascal's law and explain its applications. **(06 Marks)**

c. A force of 500 N is applied on a plunger of 5 cm diameter of a hydraulic press that moves the piston through a distance of 20 cm. What is the maximum weight of the load that can be placed on the ram and what will be the displacement of the ram, if the diameter of the ram is 40 cm. **(06 Marks)**

OR

2 a. What are the desirable properties of hydraulic fluids? Explain them. **(08 Marks)**

b. Define a seal. Explain in brief, how hydraulic seals are classified. **(08 Marks)**

c. What are the methods to control contamination in a system? **(04 Marks)**

Module-2

3 a. Explain the working principle of an external gear pump. **(05 Marks)**

b. What are the factors considered for selecting a hydraulic pump and explain the pumping theory of positive displacement pumps? **(09 Marks)**

c. A vane pump has its rotor and cam ring diameters of 60 mm and 80 mm respectively. If the volumetric displacement is 90 cm^3/rev and the width of the vane is 3 cm, what is eccentricity? What is the maximum displacement possible? **(06 Marks)**

OR

4 a. Explain the following with neat sketches:
(i) Single-acting cylinder
(ii) Telescopic cylinder **(08 Marks)**

b. What is a hydraulic motor? What are the four broad basis of classification of hydraulic motors? **(05 Marks)**

c. A hydraulic motor has a volumetric displacement of 123 cm^3 operating at a pressure of 60 bar and speed 180 rpm. If the actual flow rate consumed by the motor is 0.004 m^3/sec and actual torque delivered by motor is 100 Nm, find:
(i) Volumetric efficiency (ii) Mechanical efficiency (iii) Overall efficiency. **(07 Marks)**

Module-3

5 a. Explain with a neat sketch, the principle of working of a pilot operated pressure relief valve. Draw the graphical symbol of the valve. **(07 Marks)**

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

c. Define control valves. Explain the classification of control valves. **(07 Marks)**

OR

6 a. Explain the following with neat sketches:
   (i) Sliding spool flow control valve
   (ii) Needle flow control valve **(04 Marks)**

b. Explain the concept of meter-in and meter-out circuits. List the advantages and limitations of each of the circuit. **(10 Marks)**

c. What is a regenerative circuit? Sketch schematically regenerative circuit to increase the regenerative speed of the cylinder. **(06 Marks)**

Module-4

7 a. What are the advantages, disadvantages and applications of pneumatic system? **(07 Marks)**

b. Explain the characteristics of compressed air. **(04 Marks)**

c. Explain the construction and working of single and double acting cylinder. **(09 Marks)**

OR

8 a. Briefly explain cylinder cushioning. **(08 Marks)**

b. Explain with a suitable circuit diagram, Quick Exhaust Valve. **(06 Marks)**

c. Explain with a neat sketch, the construction of poppet valves. **(06 Marks)**

Module-5

9 a. Explain the following functions generated in pneumatic systems:
   (i) OR gate
   (ii) AND gate
   (iii) NOT gate **(12 Marks)**

b. Explain direct and indirect actuation of pneumatic cylinders. **(08 Marks)**

OR

10 a. Write short notes on the following:
   (i) Solenoid
   (ii) Electromagnetic Relay **(08 Marks)**

b. What are the advantages of cascade design? **(03 Marks)**

c. Explain with a neat sketch, coordinated sequence motion of two cylinders. **(09 Marks)**

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18ME56

Fifth Semester B.E. Degree Examination, Feb./Mar.2022
Operations Management

Time: 3 hrs. Max. Marks: 100

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

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

Module-1

1 a. Explain briefly with a schematic model the functions of business organization and operation management within them. **(08 Marks)**

b. Define productivity and explain the factors that affect productivity. **(06 Marks)**

c. Determine the productivity and multi factor productivity respectively for the cases:

(i) Four workers installed 720 sq m of carpeting in 8 hours.

(ii) For the combined input of labour and machine time using the following :

Output : 7040 units

Input : Labour : Rs. 1000.00

Materials : Rs.520.00

Overhead : Rs.2000.00 **(06 Marks)**

OR

2 a. What are models? Explain different types of models. **(06 Marks)**

b. A firm produces two types of microcomputers. The following data is available:

Profit/Unit	Rs.6000.00	Rs.5000.00
Assembly time per unit	4 hours	10 hours
Inspection time per unit	2 hours	1 hour
Storage space per unit	3 cub ft	3 cub ft

The available resources :

Resource	Amount available
Assembly time	100 hours
Inspection time	22 hours
Storage space	39 cubic feet

Formulate as LPP and solve by graphical method to find quantities of Type 1 and Type 2. **(14 Marks)**

Module-2

3 a. Explain the following forecasting methods :

(i) Linear regression

(ii) Exponential smoothing. **(08 Marks)**

b. Given the following data:

Period	Number of complaints
1	60
2	65
3	55
4	58
5	64

Prepare a forecast using each of these approaches:

(i) A three period moving average.

(ii) A weighted average using weights of 0.5 (most recent), 0.30 and 0.2.

(iii) Exponential smoothing with a smoothing constant of 0.40. **(12 Marks)**

OR

4 a. Explain the steps in the forecasting process. **(06 Marks)**

b. What is Delphi method? Brief. **(04 Marks)**

c. The mobile phone sales for a company over the last 10 weeks are shown in below table. Plot the data and visually check to see if a linear trend line would be appropriate. Then determine the equation of the trend line and predict sales for weeks 11 and 12.

Week	Unit sales	Week	Unit sales
1	700	6	742
2	724	7	756
3	720	8	750
4	726	9	770
5	738	10	780

(10 Marks)

Module-3

5 a. List the factors that determine effective capacity and explain any four. **(06 Marks)**

b. Explain bottle neck operation with a neat diagram. **(06 Marks)**

c. A small firm produces and sells automotive items in a five state area. The firm experts to consolidate assembly of its battery chargers line at a single location. Currently operations are in three widely scattered locations. The leading candidate for location will have a monthly fixed cost of Rs.42 lakhs and variable cost of Rs.200/charger. Chargers sell for Rs.700 per charger. Prepare a table that shows total profits, fixed costs variable costs, and revenues for monthly volumes of 10,000, 12,000 and 15,000 units. What is the break even point? Determine the profit when volume equals 22000 units. **(08 Marks)**

OR

6 a. What are factors that affect location decision? Explain. **(10 Marks)**

b. Fixed and variable costs for four potential plant locations are shown below:

Location	Fixed cost/year	Variable cost/unit
A	Rs.2,50,000.00	Rs.110.00
B	Rs.1,00,000.00	Rs.300.00
C	Rs.1,50,000.00	Rs.200.00
D	Rs.2,00,000.00	Rs.350.00

(i) Plot the total cost lines for these locations on a single graph.

(ii) Identify the range of output for which each alternative is superior.

(iii) If expected output at the selected location is to be 8000 units/year, which location would provide the lowest total cost? **(10 Marks)**

Module-4

7 a. Briefly explain the aggregate planning with the help of a flow chart. **(06 Marks)**

b. Given the following information setup the problem in a transportation table and solve for the minimum cost plan by least cost method.

Period	1	2	3
Demand	500	700	750
Regular	500	500	500
Capacity over time	50	50	50
Sub contract	120	120	100

Costs : Initial Inventory : 100

Regular time : Rs. 60/unit

Sub contracting : Rs. 90/unit

Inventory carrying cost : Rs.1/unit/month

Back order cost : Rs.3/unit/month **(14 Marks)**

OR

8 a. Explain master scheduling process with the help of a flow chart. **(08 Marks)**

b. Determine : the projected on hand inventory, the master production schedule and the uncommitted inventory (ATP – Available To Promise) for the following data and production capacity is 70 pumps. Forecast are shown in table.

Beginning Inventory 64	June (weeks)				July (weeks)			
Week	1	2	3	4	5	6	7	8
Forecast	30	30	30	30	40	40	40	40
Customer orders (committed)	33	20	10	4	2	-	-	-

(12 Marks)

Module-5

9 a. Explain with schematic model an overview of MRP. **(10 Marks)**

b. The Fig.Q9 (b) shows product structure tree for end Item X i.e.Chairs

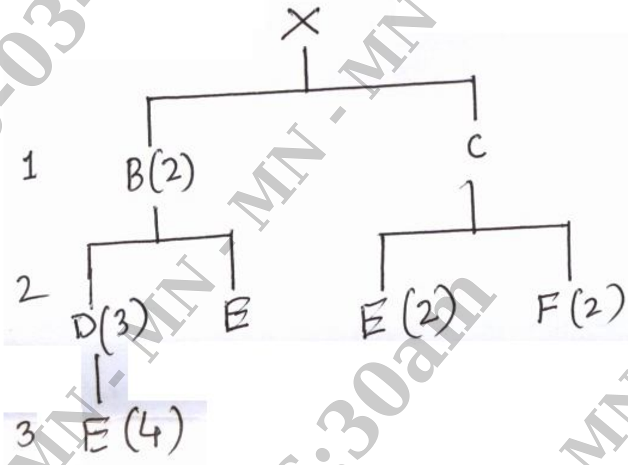

Fig. Q9 (b)

(i) Determine the quantities of B, C, D, E and F needed to assemble one X.

(ii) Determine the quantities of these components that will be required to assemble 10Xs, taking into account the quantities on hand (i.e. an inventory) of various components:

Component	On Hand
B	4
C	10
D	8
E	60

(10 Marks)

OR

10 a. What is supply chain? Explain supply chain management with a schematic model. **(10 Marks)**

b. Describe Bull whip effect with a diagram. **(05 Marks)**

c. Briefly explain elements of supply chain management. **(05 Marks)**

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18ME71

Seventh Semester B.E. Degree Examination, Feb./Mar. 2022
Control Engineering

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.

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Module-1

1 a. Explain closed loop system with an example. **(06 Marks)**

b. What are the ideal requirements of a control system? Explain them briefly. **(06 Marks)**

c. Explain proportional plus integral plus derivative control action with the characteristics. **(08 Marks)**

OR

2 a. Draw the equivalent mechanical system of the given system shown in Fig.Q2(a). Hence the set of equilibrium equations for it and obtain electrical analogous circuits using (i) F-V analogy (ii) F-I analogy.

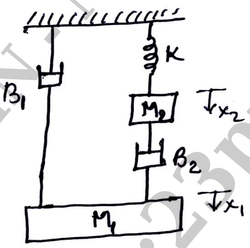

Fig.Q2(a) **(12 Marks)**

b. A thermometer is dipped in a vessel containing liquid at a constant temperature of $\theta_i(t)$. The thermometer has a thermal capacitance for storing heat as 'C' and thermal resistance to limit heat flow as R. If the temperature indicated by the thermometer is $\theta_0(t)$. Obtain the transfer function of the system. **(08 Marks)**

Module-2

3 a. Obtain an expression for response of first order system for unit step input. **(06 Marks)**

b. Explain different types of input signals. **(06 Marks)**

c. Obtain an expression for response of first order system for parabolic input. **(08 Marks)**

OR

4 a. Derive the expression of steady state error for a simple closed loop system and state the factors on which it depends. **(10 Marks)**

b. A second order system has natural frequency ω_n = 5 rad/sec and damping ratio is 0.6. Calculate (i) Delay time (ii) Rise time (iii) Peak time (iv) Maximum overshoot. **(10 Marks)**

Module-3

5 a. Reduce the given block diagram shown in Fig.Q5(a) and obtain the transfer function C(s)/R(s).

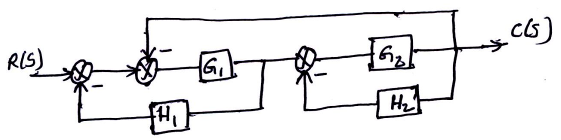

Fig.Q5(a) **(10 Marks)**

b. Find the overall transfer function by using Mason's gain formula for the signal flow graph shown in the Fig.Q5(b).

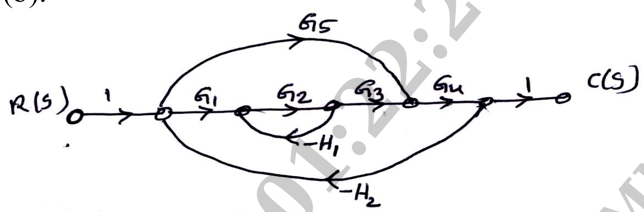

Fig.Q5(b) **(10 Marks)**

OR

6 a. Draw the corresponding signal flow graph of a given block diagram in Fig.Q6(a) and obtain transfer function by using Mason's gain formula.

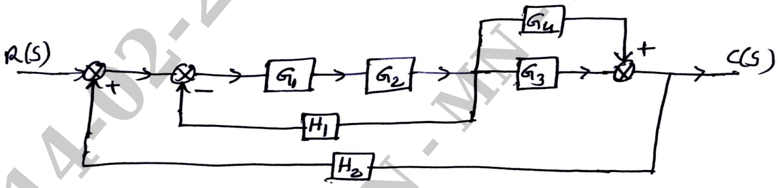

Fig.Q6(a) **(10 Marks)**

b. A system is governed by the differential equation $\frac{d^3y}{dt^3}+6\frac{d^2y}{dt^2}+11\frac{dy}{dt}+10y=8u(t)$ where y is the output and u is the input of the system. Obtain a state space representation of the system. **(10 Marks)**

Module-4

7 a. The characteristic equation of a system is given by

$$s^6 + 3s^5 + 4s^4 + 6s^3 + 5s^2 + 3s + 2 = 0$$

Determine the stability using RH criteria. **(08 Marks)**

b. By applying Routh criterion, discuss the stability of the closed loop system as a function of K for the following open loop transfer function $G(s)H(s)=\frac{K(s+1)}{s(s-1)(s^2+4s+16)}$ **(12 Marks)**

OR

8 Sketch the rough nature of root locus of a given transfer function

$$G(s)H(s)=\frac{K(s+1)}{s(s+2)(s^2+2s+5)}$$ **(20 Marks)**

Module-5

9 a. Sketch the polar plot of given transfer function

$$G(s)H(s)=\frac{1}{s(1+5s)(1+10s)}$$ **(06 Marks)**

b. The transfer function $G(s)H(s)=\frac{10}{s(s+1)(s+2)}$

Sketch the rough nature of Nyquist plot and comment on stability. **(14 Marks)**

OR

10 Draw the Bode plot for the transfer function

$$G(s)=\frac{36(1+0.2s)}{s^2(1+0.05s)(1+0.01s)}$$

From Bode plot determine :

(i) Phase crossover frequency (ii) Gain crossover frequency

(iii) Gain margin (iv) Phase margin **(20 Marks)**

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18ME72

Seventh Semester B.E. Degree Examination, Feb./Mar. 2022
Computer Aided Design and Manufacturing

Time: 3 hrs. Max. Marks: 100

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

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

Module-1

1 a. Define Automation. Explain different types of automation. **(10 Marks)**

b. The average part produced in a certain batch manufacturing plant must be processed through an average 6 machines. 20 new batches are launched each week. Average operation time is 6 mins average set-up time is 5 hrs, average batch size is 25 parts, average non-operation time per batch is 10 hrs/machine. There are 18 machines in the plant. The plant operates an average of 70 production hours per week. Scrap rate is negligible, determine:
(i) Manufacturing Load Time (MLT) for an average part (ii) Production rate
(iii) Plant capacity (iv) Plant utilization (v) WIP **(10 Marks)**

OR

2 a. What is buffer storage? Explain types of buffer storage with neat sketch. **(08 Marks)**

b. Define Upper bound approach and lower bound approach. **(04 Marks)**

c. For a 10 station transfer line, refer following data:
P = 0.01 (all stations have an equal probability of failure)
T_c = 0.5 min, T_d = 5.0 min
Using upper bound approach, determine: (i) The frequency of line stop
(ii) The average production rate (iii)The line efficiency **(08 Marks)**

Module-2

3 a. Explain with block diagram, the design process using Computer Aided Design (CAD). **(10 Marks)**

b. Explain the different functions of graphics packages. **(10 Marks)**

OR

4 a. Explain in detail the Retrieval type of CAPP. **(10 Marks)**

b. What is MRP? Explain the different inputs of MRP with block diagram. **(10 Marks)**

Module-3

5 a. Briefly explain different types of manufacturing cells. **(10 Marks)**

b. What is AS/RS? Explain different types of AS/RS. **(10 Marks)**

OR

6 a. By using the given information:
The product demand is 1800 units/week; The industry works 48 hrs/week ;
Number of operators 8 ; Uptime of assembly is 94% ; There is no repositioning required
Determine: (i) Line efficiency (ii) Balance delay (iii) Smoothness index, by using largest candidate rule method. The work elements and their times involved in the assembly operation is as below:

Element	1	2	3	4	5	6	7	8
Tek (min)	1.0	0.5	0.8	0.3	1.2	0.2	0.5	1.5
Predecessor by	-	-	1, 2	2	3	3, 4	4	5, 6, 7

(14 Marks)

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b. Define and write the mathematical model of:
   (i) Total work content time (T_{wc})
   (ii) Cycle Time (T_c)
   (iii) Smoothness Index (SI) **(06 Marks)**

Module-4

7 a. Explain briefly the steps involved in the development of a part program. **(10 Marks)**
b. List out the advantages, limitations and applications of CNC's. **(10 Marks)**

OR

8 a. Explain with neat sketches the different joints used in industrial robots. **(10 Marks)**
b. Write a short note on robot programming methods. **(10 Marks)**

Module-5

9 a. Define additive manufacturing systems and list out its advantages, disadvantages and application. **(10 Marks)**
b. With neat sketch, explain sheet lamination type AM process. **(10 Marks)**

OR

10 Write short notes on:
a. Evolution of industry 4.0
b. Big data and cloud computing for IoT
c. Supply chain optimization
d. Cyber physical manufacturing systems **(20 Marks)**

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18ME651

Sixth Semester B.E. Degree Examination, Feb./Mar. 2022
Non-Conventional Energy Sources

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.

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Module-1

1 a. What are conventional and non-conventional energy sources? **(04 Marks)**
b. Explain the energy sources from Tarsand's and oil shale. **(08 Marks)**
c. With neat sketch, explain the working principle of Pyreliometer. **(08 Marks)**

OR

2 a. Write notes on: (i) Solar constant (ii) Beam radiation (iii) Diffuse radiation **(06 Marks)**
b. Discuss the India's production and reserves of commercial energy sources. **(10 Marks)**
c. With a neat sketch, explain Sunshine recorder. **(04 Marks)**

Module-2

3 a. With reference to the solar radiation geometry, define the following:
(i) Latitude angle (ii) Declination angle (iii) Solar altitude angle
(iv) Hour angle (v) Solar Azimuth angle **(10 Marks)**
b. Calculate the angle made by beam radiation with the normal to a flat collector on December 1st at 9.00 am, solar time for a location at 28°35′ N. The collector is tilted at an angle of latitude plus 10°, with the horizontal and is pointing due south. **(10 Marks)**

OR

4 a. Explain the solar energy thermal storage system. **(08 Marks)**
b. What are the advantages and disadvantages of concentrating collectors over flat plate collectors? **(06 Marks)**
c. With neat sketch, explain the principle and working of solar pond. **(06 Marks)**

Module-3

5 a. With neat sketch, explain the main components of solar flat plate collector. **(08 Marks)**
b. Explain transmissivity based on reflection-refraction. **(08 Marks)**
c. Explain energy balance equation for liquid flat plate collector. **(04 Marks)**

OR

6 a. Discuss overall loss coefficient with respect to flat plate collectors. **(08 Marks)**
b. Explain the parameters affect the performance of the flat plate collectors. **(06 Marks)**
c. Explain the working principle of photovoltaic energy conversion. **(06 Marks)**

Module-4

7 a. Discuss the factors for wind turbine site selection. **(04 Marks)**
b. Wind at 1 standard atmospheric pressure and 15°C has velocity of 15 m/s, turbine diameter = 120 m, calculate:
(i) The total power density in the wind stream
(ii) The maximum obtainable power density
(iii) A reasonably obtainable power density
(iv) The total power **(08 Marks)**
c. With neat sketch, explain the double basin Tidal Power plant operation. **(08 Marks)**

OR

8	a.	With neat sketch, describe the closed cycle OTEC system, with its advantages over open cycle system.	**(10 Marks)**
	b.	What are the advantages and limitations of Tidal Power generation?	**(06 Marks)**
	c.	What are the advantages of vertical axis wind machines over horizontal axis wind machines?	**(04 Marks)**

Module-5

9	a.	With neat sketch, explain binary cycle geothermal power system.	**(06 Marks)**
	b.	List the disadvantages of geothermal power plants.	**(04 Marks)**
	c.	Explain with neat sketch constructional details of floating drum type (KVIC) biogas plant.	**(10 Marks)**

OR

10	a.	Discuss the application of biogas in engines.	**(06 Marks)**
	b.	With neat sketch, describe the production of hydrogen by electrolysis of water.	**(08 Marks)**
	c.	Brief the main applications of hydrogen gas.	**(06 Marks)**

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18ME734

Seventh Semester B.E. Degree Examination, Feb./Mar. 2022
Total Quality Management

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. List out benefits of Implementing TQM. **(04 Marks)**
b. With a neat diagram, explain Framework of TQM. **(06 Marks)**
c. Explain contribution made by the any two quality Guru's. **(10 Marks)**

OR

2 a. Explain briefly all eight. ISO-9001 requirements. **(10 Marks)**
b. Explain briefly various series of ISO. **(06 Marks)**
c. Briefly describe the various benefits of ISO registration. **(04 Marks)**

Module-2

3 a. Explain briefly seven characteristics of effective people. **(06 Marks)**
b. List out Deming's 14 points of TQM philosophy and explain any three. **(10 Marks)**
c. Explain role of TQM leader. **(04 Marks)**

OR

4 a. Enumerate the seven steps to strategic planning. **(10 Marks)**
b. Explain different ways of communication. **(06 Marks)**
c. Explain briefly decision making process. **(04 Marks)**

Module-3

5 a. With a neat sketch enumerate how a KANO MODEL help in translating needs into requirements. **(08 Marks)**
b. Describe briefly the customer retention. **(06 Marks)**
c. Explain briefly customer perception towards quality. **(06 Marks)**

OR

6 a. State and explain elements of customer service. **(08 Marks)**
b. Define, motivation, performance, reward, recognition, empowerment, gain sharing, teams and union. **(08 Marks)**
c. List out advantages of employee involvement. **(04 Marks)**

Module-4

7 a. Sketch and explain Juran's Triology. **(10 Marks)**
b. Explain with neat diagram P-D-S-A cycle for continuous improvement. **(06 Marks)**
c. Write note on six sigma. **(04 Marks)**

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OR

8	a.	Explain with neat diagram, cause and effect diagram, Pareto diagram.	**(08 Marks)**
	b.	Explain various measures of central Tendency and Measure of Dispersion.	**(08 Marks)**
	c.	Write note on control charts.	**(04 Marks)**

Module-5

9	a.	Define total productive maintenance and explain briefly its 8 pillars.	**(08 Marks)**
	b.	Explain briefly 5 "s" foundation applied to total productive maintenance.	**(08 Marks)**
	c.	Write notes on types of maintenance.	**(04 Marks)**

OR

10	a.	Define QbD and explain key component of quality by design.	**(08 Marks)**
	b.	Define EMS and explain its benefits.	**(04 Marks)**
	c.	Explain the concept of environment management system under ISO14001.	**(08 Marks)**

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18ME741

Seventh Semester B.E. Degree Examination, Feb./Mar. 2022
Additive Manufacturing

Time: 3 hrs. Max. Marks: 100

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

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

Module-1

1 a. Define Additive Manufacturing. With neat sketch, explain Genetic A.M. process. **(10 Marks)**
b. Briefly distinguish any five differences between AM and ANC machining. **(10 Marks)**

OR

2 a. List and explain varieties of materials used in A.M. process. **(10 Marks)**
b. Discuss material handling issues in A.M. Process. Mention any five applications of A.M. process. **(10 Marks)**

Module-2

3 a. With neat sketch, explain Stereolithography process. **(10 Marks)**
b. Briefly explain the benefits and drawbacks of photopolymerization process. **(10 Marks)**

OR

4 a. Briefly explain the process of Selective Laser Sintering. **(10 Marks)**
b. With neat sketch, explain Fused Deposition Modeling (FDM) process. **(10 Marks)**

Module-3

5 a. What is Laminated Object Manufacturing? With neat sketch, explain gluing techniques. **(10 Marks)**
b. With neat sketch, brief the Ultrasonic Additive manufacturing. **(10 Marks)**

OR

6 a. Briefly explain Laser Transfer direct. Write with neat sketch. **(10 Marks)**
b. Briefly discuss the applications of direct write technology. **(10 Marks)**

Module-4

7 a. With neat sketch, brief the Flow chart of A.M. selection. **(10 Marks)**
b. Briefly explain the Surface Texture improvements and Accuracy Improvements in Post process of A.M. **(10 Marks)**

OR

8 a. With neat sketch, briefly explain the properties enhancements using Thermal techniques. **(10 Marks)**
b. Briefly discuss how STL file is manipulated in A.M. **(10 Marks)**

Module-5

9 a. Briefly explain Multi – material process mechanism in A.M. process. **(10 Marks)**
b. What are the factors enable the DDM application in A.M. process. **(10 Marks)**

OR

10 a. Briefly discuss the use of A.M. in Medical applications and Dental applications. **(10 Marks)**
b. Briefly explain the application of A.M. in Aerospace and Automobile sectors. **(10 Marks)**

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18ME751

Seventh Semester B.E. Degree Examination, Feb./Mar. 2022

Energy and Environment

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. List and explain different forms of Energy. **(10 Marks)**
b. Explain briefly the factors affecting India's Energy development. **(10 Marks)**

OR

2 a. Discuss briefly the Demand and Consumption of coal in India. **(10 Marks)**
b. Explain the various key Energy trends in India. **(10 Marks)**

Module-2

3 a. Explain various Thermal Storage Systems. **(10 Marks)**
b. Explain the principles of Energy Management System. **(10 Marks)**

OR

4 a. Define Energy Audit and explain different phases involved in detailed Energy Audit Methodology. **(10 Marks)**
b. What is Energy Management? Explain Energy Management System and Energy Management Clarified Objectives. **(10 Marks)**

Module-3

5 a. What is Environment? Explain its Multidisciplinary Nature. **(10 Marks)**
b. Explain Scope and importance of Environment for Public awareness. **(10 Marks)**

OR

6 a. Explain structure and functions of Ecosystems. **(10 Marks)**
b. Write a short note on : i) Ecological Pyramid ii) Forest Ecosystem. **(10 Marks)**

Module-4

7 a. Discuss the causes, effects and control measures of Water Pollution. **(10 Marks)**
b. Discuss Solid Waste Management Techniques. **(10 Marks)**

OR

8 a. Explain the causes, effects and control measures of Soil Pollution. **(10 Marks)**
b. Discuss the role of an Individuals in Preventions of Pollutions. **(10 Marks)**

Module-5

9 a. Write a note on : Ozone Layer Depletion. **(10 Marks)**
b. What are the Regulation governing for Water Pollution Prevention Act? **(10 Marks)**

OR

10 a. Write a short note on : i) Global warming ii) Acid rain. **(10 Marks)**
b. Explain the needs for Reclaiming the wasteland and its development. **(10 Marks)**

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