BharatiyaVidyaBhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)

Munshi Nagar, Andheri (W) Mumbai – 400058

T.Y. B. Tech (Mech) Sem V 21/7/22

END SEM

KT July 2022

Program: Mechanical Engineering
Course Code: PC-BTM 501
Course Name: Heat and Mass Transfer

Duration: 3 Hr.
Maximum Points: 100
Semester: V

Instructions:

- **Question No 1 is compulsory.**
- Attempt **any Four questions** out of Six questions.
- Answers to all sub questions should be grouped together.
- Figures to the right indicate full marks.
- Make suitable assumptions with proper explanations.
- Draw the suitable sketches wherever necessary

Q. No.	Questions	Pts	CO	BL	PI
1.	**Answer the following questions (any Five)** **A.** What is shape factor? State its properties. **B.** State and explain Kirchhoff's law of radiation. What is intensity of radiation? **C.** Differentiate between natural and forced convection. **D.** Explain the importance and physical significance of: Biot number and Fourier number in transient conduction. **E.** State and explain Fourier's law for one-dimensional heat conduction. What are the assumptions to be considered for this law? **F.** Explain with examples the three modes of heat transfer. Differentiate between steady & unsteady state heat transfer.	20	1	2	1.3.1
2. A	An aluminium pipe carries steam at 110°C. The pipe (K = 185 W/mK) has an inner diameter of 100 mm and outer diameter of 120 mm. The pipe is located in a room where the ambient air temperature is 30°C and the convective heat transfer coefficient between the pipe and air is 15 W/m^{2}K. Determine the heat transfer rate per unit length of pipe. To reduce the heat loss from the pipe, it is covered with a 50 mm thick layer of insulation (K = 0.20 W/mK). Determine the heat transfer rate per unit length from the insulated pipe. Assume that the convective resistance of the steam is negligible.	10	3	3	2.4.2
2. B	A cylindrical ingot 10 cm diameter and 30 cm long passes through a heat treatment furnace. The ingot must reach a temperature of 800°C before it comes out of the furnace. The furnace gas is at 1250°C and ingot initial temperature is 90°C. The convective heat transfer coefficient is 100 W/m^{2}K. Consider surface area including cross	10	3	3	2.4.2

	sectional area of the ingot. Calculate the time required for the ingot to reach a temperature of 800°C. Take Properties of steel as K= 40 W/mK, ρ = 7800 kg/m^3, Sp. heat C = 2000 J/kgK.				
3. A	Derive an expression for LMTD for parallel flow heat exchanger.	10	1	2	1.3.1
3. B	A refrigerated truck is moving at a speed of 90 km/hr where the ambient temperature is 50°C. The body of the truck is of rectangular shape of size 10m (length) x 4m (width) x 3m (height). Assume that the boundary layer is turbulent on the four walls and the wall surface temperature is at 10°C. Neglect heat transfer from vertical front and backside of truck and flow of air is parallel to 10 m long side, calculate the heat loss from the four surfaces and power required to overcome the resistance acting on the four surfaces. For turbulent flow over flat surfaces: $\mathbf{Nu = 0.036\ (Re)^{0.8}\ (Pr)^{0.33}}$ The thermo-properties of air at bulk mean temperature are: ρ = 1.165 kg/m^3, Cp = 1005 J/kgK, K = 0.02673 W/m^{2}K, ν = 16 x 10-6 m^2/s, Pr = 0.701	10	3	3	2.4.2
4. A	Calculate the heat transfer from 60 W incandescent bulb at 115°C to ambient air at 25°C. Assume the bulb as a sphere of 50 mm diameter. Also, find the percentage of power lost by free convection. Use equation: $\mathbf{Nu = 0.60\ (Gr.Pr)^{0.25}}$ The thermo-properties of air at bulk mean temperature are: Cp = 1005 J/kgK, K = 0.02964 W/m^{2}K, ν = 20 x 10-6 m^2/s, Pr = 0.694	10	3	3	.4.2
4. B	A chemical having specific heat of 3.3 kJ/kgK flowing at the rate of 20000 kg/h enters a parallel flow heat exchanger at 120°C. The flow rate of cooling water is 50000 kg/h with an inlet temperature of 20°C. The heat transfer area is 10 m^2 and the overall heat transfer coefficient is 1050 W/m^{2}K. **Use ε-NTU method** to solve this problem. Use Sp. heat of water as 4.186 kJ/kgK. Find: (1) The effectiveness of heat exchanger, (2) The outlet temperature of water and chemical	10	3	3	2.4.2
5. A	Liquid oxygen (boiling temperature = -182°C) is to be stored in spherical container of 30 cm diameter. The system is insulated by an evacuated space between inner space and surrounding 45 cm inner diameter concentric sphere. For both spheres ε = 0.03 and temperature of the outer sphere is 30°C. Estimate the rate of heat flow by radiation to the oxygen in the container.	10	3	3	2.4.2
5. B	Hydrogen gas at 25°C and 2.5 bar pressure flows through a rubber tubing of 12 mm inside radius and 24 mm outside radius. The binary diffusion coefficient of hydrogen is 2.1 x 10^{-8} m^2/s and the solubility	10	3	3	2.4.2

	of hydrogen is 0.055 m^3 of hydrogen per m3 of rubber at 1 bar. If the gas constant for hydrogen is 4160 J/kg.K and the concentration of hydrogen at the outer surface of tubing is negligible, calculate the diffusion flux rate of hydrogen per meter length of rubber tubing.				
6. A	A heat exchanger is required to cool 55,000 kg/hr of alcohol from 66°C to 40°C using 40,000 kg/hr of water entering at 5°C. Calculate: (a) exit temperature of water, (b) heat transfer rate, (c) surface area required for (i) parallel flow type, (ii) counter flow type of heat exchanger. Take Cp (alcohol) and Cp (water) as 3760 and 4180 J/kg.K respectively. Take overall heat transfer coefficient as 580 $W/m^2.K$.	**10**	**3**	**3**	**2.4.2**
6. B	Explain with neat sketches thermal and velocity (hydrodynamic) boundary layers. What are the criteria for laminar to turbulent flow in forced convection?	**10**	**2**	**2**	**2.4.2**
7.	**Answer the following questions (Any Five)** **A.** What are the Uses of Dimensional Analysis? and state applications of dimensional homogeneity. **B.** State and Explain Fick's law of diffusion and compare it with Fourier law of conduction. **C.** How is the utility of extended surfaces? List the assumptions made while analyzing the heat flow from a finned surface. **D.** What is meant by transient heat conduction? What are the assumptions to be considered for lumped capacity analysis? **E.** State the examples of mass transfer in day-to-day life and industrial applications. **F.** What do you mean by critical radius of insulation? How is it defined for a cylinder?	**20**	**1**	**2**	**1.3.1**

T.Y. B. Tech (Mech) Sem V 7/3/22

BharatiyaVidyaBhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)
Munshi Nagar, Andheri (W) Mumbai – 400058

RE-EXAM END SEM
ODD SEM MAR 2022

Program: Mechanical Engineering
Course Code: PC-BTM 501
Course Name: Heat and Mass Transfer

Duration: 3 Hr.
Maximum Points: 100
Semester: V

Instructions:

- **Question No 1 is compulsory.**
- Attempt **any Four questions** out of Six questions.
- Answers to all sub questions should be grouped together.
- Figures to the right indicate full marks.
- Make suitable assumptions with proper explanations.
- Draw the suitable sketches wherever necessary

Q. No.	Questions	Pts	CO	BL	PI
1.	**Answer the following questions (any Four)** **A.** Define the terms: Total Emissive Power (E), Monochromatic Emissive Power, Emissivity, and Intensity of radiation. **B.** What is a black body? How does it differ from a gray body? **C.** What is lumped capacity? What is meant by transient heat conduction? **D.** What is the critical radius of insulation? How is it defined for a cylinder? **E.** Define Reynolds Analogy.	20	1	2	1.3.1
2. A	Calculate the rate of heat flow per unit area through a furnace wall consisting of 200 mm thick inner layer of chrome brick, a centre layer of kaolin brick 100 mm thick and an outer layer of masonry brick 100 mm thick. The inside surface (furnace side) heat transfer coefficient is 74 W/m^{2}K and the outer wall surface is 70°C. The temperature of the inside gases of the furnace is 1670°C. Also calculate the inner wall (Chrome brick) surface temperature and outside surface temperature of middle (Kaolin) brick. Take: K for chrome brick = 1.25 W/mk, K for kaolin brick = 0.074 W/mk, K for masonry brick = 0.555 W/mk.	10	3	3	2.4.2
2. B	An egg with mean diameter of 40 mm and initially at 20°C is placed in a boiling water pan for 4 minutes and found to be boiled to the consumer's taste. For how long should a similar egg for same consumer be boiled when taken from a refrigerator at 5°C. Use lump theory. Take the following properties for egg:	10	3	3	2.4.2

	$K = 10$ W/m°C, $\rho = 1200$ Kg/m^3, $C = 2$ KJ/Kg°C and h (heat transfer coefficient) = 100 W/m^2 °C.				
3. A	**A)** What are the various applications of heat exchangers?	10	3	3	2.4.2
	B) Define Thermal conductivity and briefly explain its significance in heat transfer.				
3. B	Air stream at 24°C is flowing at 0.4 m/s across a 100 W incandescent bulb at 130°C. If the bulb is approximated by 65 mm diameter sphere, calculate: The heat transfer rate, and 1. The percentage of power lost due to convection. Use equation: $\mathbf{Nu = 0.37\ (Re)^{0.60}}$ The thermo-properties of air at bulk mean temperature are: $K = 0.03$ W/m^{2}K, $v = 2.08 \times 10^{-6}$ m^2/s, $Pr = 0.697$	10	3	3	2.4.2
4. A	A cylindrical body of 300 mm diameter and 1.6 m height is maintained at a constant temperature of 37°C. The surrounding air temperature is 14°C. Find out the amount of heat to be generated by the body per hour. Use equation: $\mathbf{Nu = 0.12\ (Gr.Pr)^{0.33}}$ The thermo-properties of air at bulk mean temperature are: $Cp = 1005$ J/kgK, $K = 0.02673$ W/m^{2}K, $v = 16 \times 10^{-6}$ m^2/s, $Pr = 0.701$	10	3	3	2.[illegible]
4. B	Derive an expression for LMTD for Counter flow heat exchanger with neat sketch.	10	3	3	2.4.2
5. A	Two large parallel plates at temperature 1000 K and 600 K have emissivity of 0.5 and 0.8 respectively. A radiation shield having emissivity 0.1 on one side and 0.05 on the other side is placed between the plates. Calculate the heat transfer rate by radiation per square meter with and without radiation shield.	10	3	3	2.4.2
5. B	1) State Fick's law of diffusion. Define the various symbols used and give their units.	05	1	2	1.3.1
	2) What are the limitations of Fick's law of diffusion? And list and explain various modes of mass transfer.	05	1	2	1.3.[illegible]
6. A	The flow rates of hot and cold water streams running through a parallel flow heat exchanger are 0.2 kg/s and 0.5 kg/s respectively. The inlet temperatures on the hot and cold sides are 75°C and 20°C respectively. The exit temperature of hot water is 45°C. If the individual heat transfer coefficients on both sides are 650 W/m^{2}K, calculate the area of the heat exchanger.	10	3	3	2.4.2
6. B	State and explain Kirchhoff's law of radiation. What is intensity of radiation? Prove that total emissive power is π times the intensity of radiation.	10	2	2	2.4.2

7.	**Answer the following questions (Any Four)**	**20**	**1**	**2**	**1.3.1**

A. What is Newton's law of viscosity? What is the relation between kinematic viscosity and dynamic viscosity?

B. Explain the radiation shield with its applications.

C. How are heat exchangers classified? Define effectiveness of heat exchanger.

D. State and explain different types of non-dimensional numbers used in free and forced convection.

E. State and explain different types of Fouling observed in heat exchangers

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)
Munshi Nagar, Andheri (W) Mumbai – 400058

Previous Semester Examinations – July 2022

T. Y. B.Tech (Sem V) Mechanical

Program: B.Tech
Course Code: PC-BTM514
Course Name: Thermal Systems

Duration: 3 Hours
Maximum Points: 100
Semester: V

26/7/22

Notes:

1. Question number ONE is compulsory and solve any FOUR questions out of remaining SIX.
2. Steam table and Mollier diagram is allowed to use.
3. All sub questions are to be grouped together.
4. Assume suitable data wherever necessary and justify the same.

Q.No.	Questions	Points	CO	BL	PI
1(a)	Explain pressure and velocity compounding in steam turbine.	5	1,3	1	1.3.1
1(b)	What is volumetric efficiency of the reciprocating compressor and derive equation for it. Also explain volumetric efficiency referred to ambient conditions.	5	1,3	1	1.3.1
1(c)	Differentiate between Rotary and Reciprocating Compressors.	5	1	1	1.3.1
1(d)	What are boiler accessories? Explain working of economiser with neat sketch.	5	1,3	1	1.3.1
2(a)	Prove that for nozzle the condition of pressure ratio for maximum discharge is given by: $\frac{P_2}{P_1} = \left(\frac{2}{n+1}\right)^{\frac{n}{n-1}}$	8	3	1	1.3.1
(b)	A two stage double acting air compressor operating at 250 rpm takes air in at 1.013 bar and 27^0 C. The diameter and stroke of L.P cylinder are 37 cm and 40 cm respectively. The stroke of H.P cylinder is same as L.P. cylinder and clearance of both the cylinder is 5% of the stroke. The L.P. cylinder discharges air at a pressure of 4.052 bar. The air passes through the intercooler so that it enters the H.P. cylinder at 27^0 C and 3.85 bar. Finally, the air is discharged from the compressor at 15.4 bar. The compression and re-expansion in both the cylinder follows the same law $pv^{1.3}$ =Constant. Determine (i) Brake power required to run the compressor if mechanical efficiency is 85 % (ii) The diameter of H.P. cylinder	12	2	3	2.4.1

	(iii) Heat rejected in intercooler. Take C_p = 1 kJ/kg-K and R = 287 J/kg-K for air.				
3(a)	Explain with neat sketch working of root blower and vane-type blower.	10	2	1	1.3.1
(b)	Steam at a pressure of 15 bar with 50°C of superheat is allowed to expand through a convergent-divergent nozzle. The exit pressure is 1 bar. If the nozzle is required to supply 2 kg/sec of steam to the turbine, then calculate: (i) Velocities at throat and exit. (ii) Areas at throat and exit.	10	4	2	2.4.1
4(a)	Draw a neat diagram of Cochran boiler and explain its working.	10	3	1	1.3.1
(b)	Explain what are boiler mountings and accessories. Explain with neat sketch spring loaded safety valve.	10	3	1	1.3.1
5(a)	Explain the phenomenon of surging and chocking in centrifugal compressors.	10	1	1	1.3.1
(b)	Draw a neat sketch of non-mixing type surface condenser and explain its working.	10	3	1	1.3.1
6(a)	A steam turbine develops 160 kW with a consumption of 19.4 kg/kWh. The pressure and temperature of the steam entering the nozzle are 12 bar and 220°C. The steam leaves the nozzles at 1.2 bar. If the diameter of the nozzle at throat is 7 mm, find the number of nozzles required. If 8 % of the total enthalpy drop is used up in frictional reheating in the diverging part of the nozzle, determine the diameter at the exit of nozzle and quality of steam leaving the nozzle.	10	4	3	1.3.1
(b)	What are the methods of improving efficiency of open cycle gas turbine? Explain all the methods with neat sketches of each method.	10	3	1	1.3.1
7(a)	Explain the working of Pelton turbine with neat sketch.	06	3	1	1.4.1

(b)	In a gas turbine power plant the compressed air goes to combustion chamber through regenerator. This air is then expanded over the turbine and passed through regenerator. The following data is given: Isentropic efficiency of compressor = 0.83, Isentropic efficiency of turbine = 0.85, Mechanical transmission efficiency = 0.99, Combustion efficiency = 0.98, Heat Exchanger effectiveness =0.80, Pressure ratio = 4.0, Maximum cycle temperature = 11000 K, Ambient conditions = 1 bar and 288 K. Calorific value of fuel = 42 000 kJ/kg. Calculate specific work output, specific fuel consumption and cycle efficiency. Neglect mass of fuel while calculating heat taken by gases. Take C_p = 1.005 kJ/ kg-K , γ = 1.4 during compression and C_p = 1.147 kJ/kg-K, γ = 1.33 during combustion and expansion.	14	4	3	2.4.1

Bharatiya Vidya Bhavan's
SARDAR PATEL COLLEGE OF ENGINEERING
(Government Aided Autonomous Institute)
Munshi Nagar, Andheri (W) Mumbai – 400058

Re-Examinations – March 2022

10/3/22

T.Y. B.Tech (Mech) Sem V

Program: B.Tech **Duration: 3 Hours**
Course Code: PC-BTM514 **Maximum Points: 100**
Course Name: Thermal Systems **Semester: V**

Notes:

1. Question number ONE is compulsory and solve any FOUR questions out of remaining SIX.
2. Steam table and Mollier diagram is allowed to use.
3. All sub questions to be grouped together.
4. Assume suitable assumptions wherever necessary and justify the same.

Q.No.	Questions	Points	CO	BL	PI
1(a)	Explain volumetric efficiency for reciprocating air compressor and derive expression for it.	5	1,3	1	1.3.1
1(b)	Explain pressure and velocity compounding in steam turbine.	5	1,3	1	1.3.1
1(c)	Draw neat sketch of economizer and explain its working	5	1,3	1	1.3.1
1(d)	Describe all the elements of condensing plant with its use.	5	1,3	1	1.3.1
2(a)	Explain in detail working of evaporative condenser with its neat sketch.	8	1	1	1.3.1
(b)	A two-stage double acting air compressor, operating at 200 RPM takes in air at 1.013 bar and 27°C. The size of L.P. cylinder is 350 x 380 mm; the stroke of H.P. cylinder is same as that of L.P. cylinder and the clearance of both the cylinders is 4 % of respective stroke. The L.P. cylinder discharges the air at a pressure of 4.052 bar. The air passes through the inter-cooler so that it enters the H.P. cylinder at 27°C and 3.850 bar, finally it is discharged from the compressor at 15.4 bar. The value of n in both cylinders is 1.3. C_p = 1.0035 kJ/kgK and R = 0.287 kJ/kg-K. Evaluate (i) the heat rejected in the inter-cooler, (ii) the diameter of H.P. cylinder and (iii) the power required to drive H.P. cylinder.	12	2	3	2.4.1
3(a)	Explain advantages and limitations of rotary verses reciprocating compressors and axial verses centrifugal compressors.	10	2	1	1.3.1
(b)	Steam at a pressure of 15 bar with 200°C of superheat is allowed to expand through a convergent-divergent nozzle. The exit pressure is 1 bar. If the nozzle is required to supply 2 kg/sec of steam to the turbine, then calculate (i) velocities at	10	4	3	2.4.1

	throat and exit (ii) areas at throat and exit.				
4(a)	Draw a neat sketch of Cochran boiler and explain it in detail stating its main features.	10	3	1	1.3.1
(b)	The following data refer to one stage of an impulse turbine: Isentropic nozzle heat drop = 185 kJ/kg. Reheat of steam due to blade friction = 10% of isentropic drop, Nozzle angle = 20°. Ratio of blade speed to whirl component of steam speed = 0.5 Velocity coefficient for the blades = 0.95 Take this velocity of steam at the entry of nozzle = 30 m/sec. Find (i) blade angle if the steam leaves axially, (b) work done per kg and (c) friction loss over the blades and K.E. loss.	10	3	1	1.3.1
5(a)	Explain the phenomenon of surging and chocking in centrifugal compressors.	10	3	1	1.3.1
(b)	Explain use of boiler mountings and accessories. Explain with neat sketch economizer and superheater.	10	3	1	1.3.1
6(a)	Explain with neat sketch working of root blower and vane-type blower.	10	3	3	1.3.1
(b)	Prove that condition for maximum blade efficiency in case of 50% reaction turbine is given by relation: $\eta_b = \frac{2\cos^2\alpha}{1+\cos^2\alpha}$	10	3	3	1.3.1
7(a)	Explain methods to improve efficiency of open cycle gas turbine.	08	3	3	1.3.1
(b)	In an open cycle constant pressure gas turbine, air enters the compressor at 1 bar and 300K. The pressure of air after compression is 4 bar. The isentropic efficiencies of compressor and turbine are 78% and 85% respectively. The air-fuel ratio is 80:1. Calculate the power developed and thermal efficiency of the cycle if the flow rate of air is 3 kg/sec. Take C_p=1.005 kJ/kg-K and γ=1.4 for air and C_p=1.14 kJ/kg-K and γ=1.33 for gases. R=0.287 kJ/kg-K C.V. of fuel = 42000 kJ/kg.	12	4	3	2.4.1

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)
Munshi Nagar, Andheri (W) Mumbai – 400058

8/3/22

T.Y. B. Tech (Mech) Sem V

Previous Semester Examination - March 2022	
Program: B. Tech in Mechanical Engineering	**Duration: 3 Hrs**
Course Code: PC – BTM515	**Maximum Points: 100**
Course Name: Computer Aided Machine Drawing	**Semester: V**

Note:

1. Question no. 1 is Compulsory
2. Answer **any Three** out of remaining Five questions.
3. Answer to all sub questions must be grouped together
4. Assume suitable data if necessary.

Important Instructions:

1. All drawings (In AutoCad) should be submitted in a Title sheet layout with title block filled with respective details.
2. All drawings of all questions to be compiled in one folder in :D/ drive
3. Save File Name as <**Reg. No.**>_<ReExam Mar 2022> [E.g. **M171001_ReExam Mar 2022**]
4. Free Hand Sketches and Calculation of Limits should be written in Sheets only.
5. **Save Your Work Regularly in AutoCad.**

Q. No.		Points	CO/ MO	BL	PI
Q.1 (a)	Given in **Figure A** is Details of Spigot and Socket Joint. Assemble the parts and draw the following views with Bill of Material. (i) Sectional Front View (ii) Side View	15	03/ 03	03	5.2.2
Q.1(b)	Draw Free Hand Sketches of the following: (i) Square Nut (ii) Hook Bolt	10	02/ 02	01	1.4.1
Q.2(a)	A vertical square prism, side 50 mm is completely penetrated by a horizontal square prism, side 35 mm so that the axis of horizontal prism is at right angle with axis of vertical prism. The axis of horizontal prism is parallel to the H.P. & V.P. Draw the projections of the prisms showing lines of intersections. Take the length of both the prisms as 100 mm.	15	01/ 01	03	5.2.2
(b)	Draw Free Hand Sketches of the following: (i) British Standard Whitworth (BSW) Thread (ii) Metric Thread	05 05	02/ 02	01	1.4.1
Q.3 (a)	Given in the **Figure B** is the Details of Simple Flange Coupling. Assemble the parts and draw the following with Bill of Material: (i) Sectional Front View. (ii) Side View.	20	04/ 04	03	5.2.2

Q.3 (b)	Draw Free Hand Sketches of the following: (i) Flat Saddle Key	05	02/ 03	01	1.4.1
Q.4	Given in **Figure C** is Assembly of Gate Valve. Draw the detail views as given below: (i) **Body:** a) Sectional Front View b. Side View (ii) **Spindle:** a) Front View (iii) **Handle:** a) Sectional Front View b) Side View	12 05 08	03/ 05	03	5.2.2
Q.5	Given in **Figure D** is Details of Expansion Joint. Draw the assembly view as given below with Bill of Material. (i) Sectional Front View (ii) Calculate the Hole Limits ø 170 **H7 and g6**	20 05	04/ 06	03	5.2.2
Q.6	Given in **Figure E** is Assembly of Drill Jig. Identify the following parts and draw their views as directed: (i) **Jig Plate** – (a) Sectional Front View (b) Top View (ii) **Stem** – (a) Sectional Front View (iii) **Latch Washer** (a) Sectional Front View (b) Top View	12 05 08	03/ 07	03	5.2.2

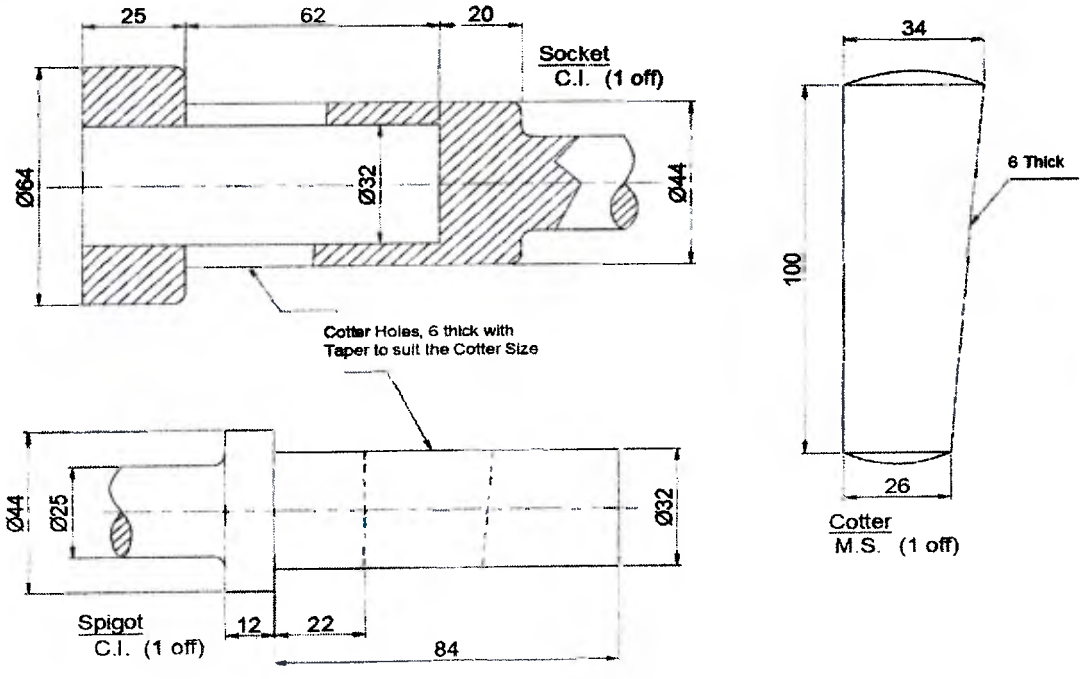


Figure A: Details of Spigot and Socket Joint

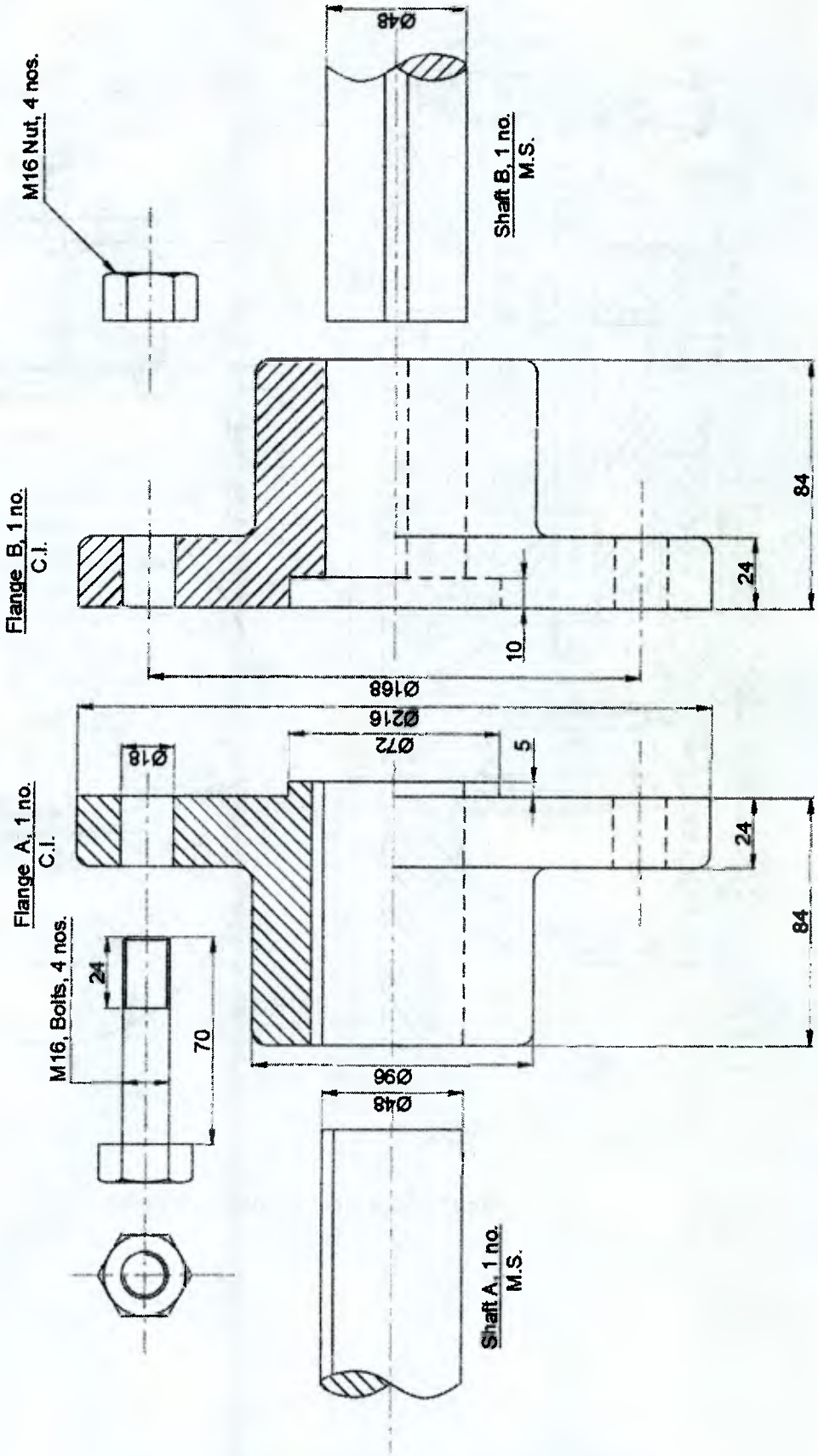
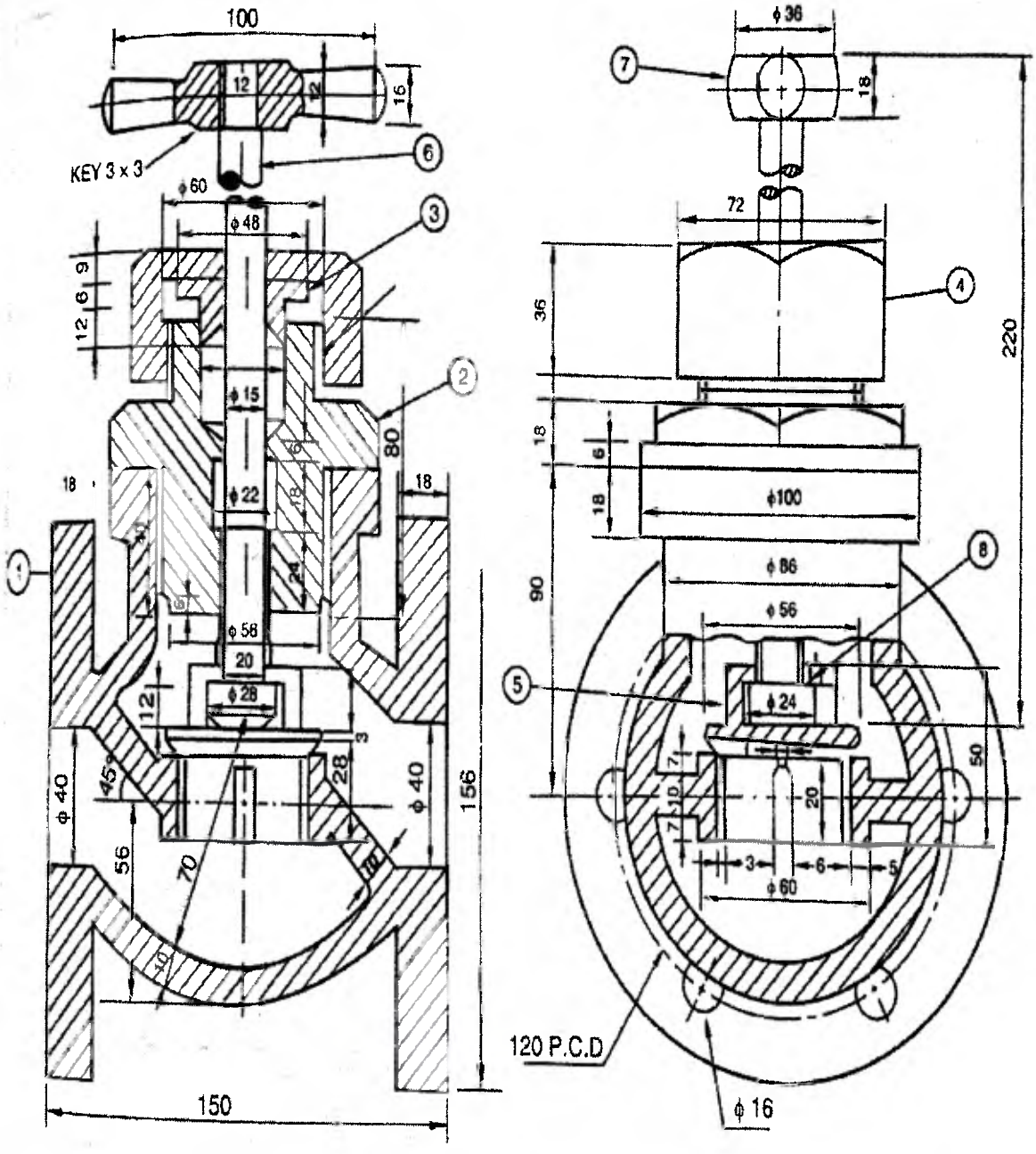


Figure B: Details of Simple Flange Coupling



Sectional Front View

Side View

Figure C: Assembly of Gate Valve

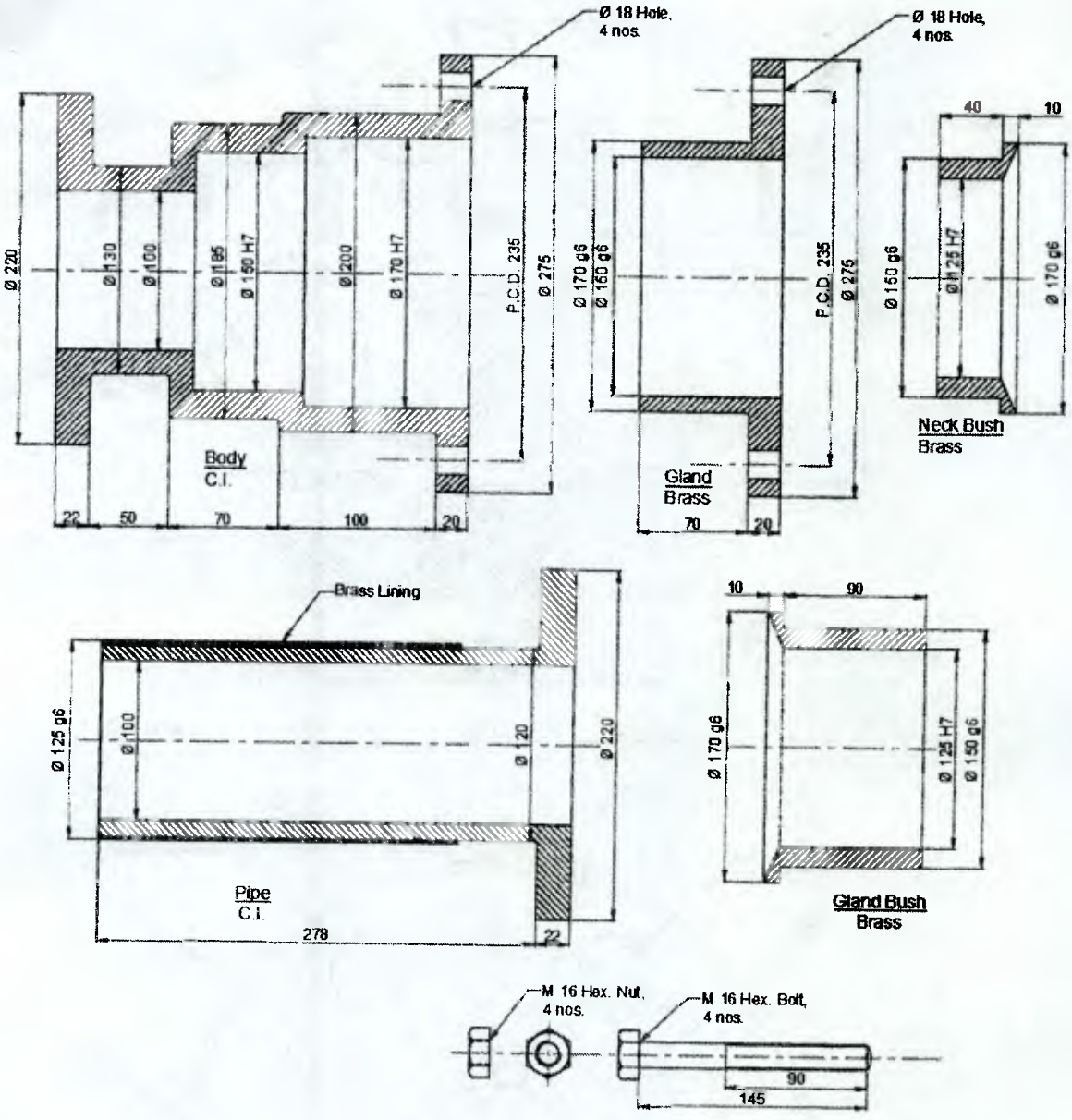


Figure D: Details of Expansion Joint

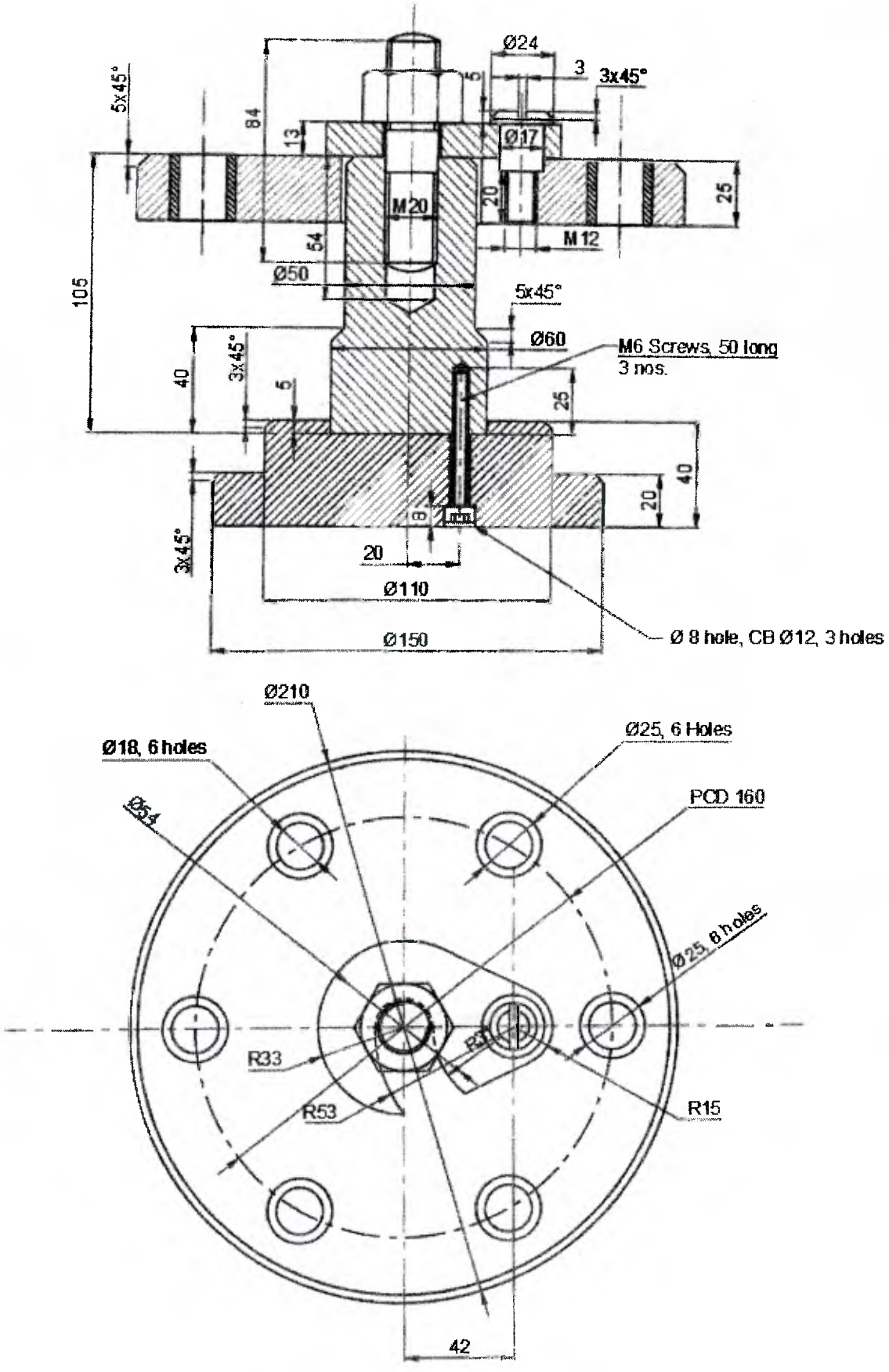


Figure E: Assembly of Drill Jig

9/3/22

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)
Munshi Nagar, Andheri (W) Mumbai – 400058

RE- EXAMINATION MARCH 2022

Program: T Y Mechanical **Duration: 3 Hrs.**

Course Code: PC-BTM 503 **Maximum Points: 100**

Course Name: Mechatronics

Semester: V

Notes: 1. Solve any FIVE

2. Assume suitable data if required

Q.No.	Questions	Points	CO	BL	PI
Q.1	Solve any Five	20			
a)	**Explain** Mechatronics Design Process	04	01	II	2.1.2
b)	**Discus** 8085 Memory Organization	04	01	II	1.3.1
c)	**Explain** Pin diagram of 8051	04	01	II	1.3.1
d)	**Describe** the applications of Mechatronics	04	01	II	2.1.2
e)	**Enlist** the advantages and disadvantages of Hydraulics	04	02	I	1.4.1
f)	**Demonstrate** the types of Control System	04	03	III	2.1.2
Q2 a)	**Create** the architecture of 8050 and each term in brief	10	01	VI	1.3.1

RE- EXAMINATION MARCH 2022

Q2 b)	**Create** the architecture of 8051 and each term in brief	10	01	VI	1.3.1
Q3 a)	**Explain** the Root Locus with angle and magnitude condition.Consider unity feed back system with G(s)= k/s , obtain its root locus.	10	03	II	1.3.1
Q3 b)	For G(s)H(s) = K/s(s+2) , **predict** the nature of Root Locus	10	03	III	2.1.2
Q4 a)	**Explain** Bode Plot with magnitude plot and phase angle plot	10	03	II	1.3.1
Q4 b)	A unity feedback control system has G(s)= 80 /s(s+2)(s+20).**Draw** the Bode plot. Determine GM, PM, pc, gc. **Comment** on stability.	10	03	IV	1.3.1
Q5 a)	**Explain** the State Space Model with suitable example.	10	04	II	2.4.1
Q5 b)	**Obtain** the State Space model for Mechanical System with Spring Mass Damper	10	04	III	2.4.1
Q6 a)	**Explain** Meter-in and Meter-out circuit	10	02	II	1.4.1
Q6 b)	**Explain** the Cascade Circuit with suitable example	10	02	II	1.4.1

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)
Munshi Nagar, Andheri (W) Mumbai – 400058

RE- EXAMINATION MARCH 2022

Sem V 11/3/22

T.Y. B. Tech (Mech)

Program: B. Tech. **Duration: 3 hours**

Course Code: PC–BTM512 **Maximum Points: 100**

Course Name: Dynamics of Machinery **Semester: V**

Instructions:

1. All questions are compulsory.
2. Each question carries equal marks.
3. Assume suitable data wherever necessary and justify the same.

Q.No.	Questions	Points	CO	BL	PI
Q1	a) Explain Bevis-Gibson Torsion Dynamometer. b) Find the maximum and minimum speeds of a flywheel of mass 3250 Kg and radius of gyration 1.8 m when the fluctuation of energy is 112 KNm. The mean speed of engine is 240 rpm.	10 10	1	3	3.4.1
Q2	a) One of the driving axels of a locomotive with its two wheels has a moment of inertia of 350 Kgm. The wheels are of 1.85 m diameter. The distance between the planes of the wheels is 1.5 m. When travelling at 100 km/hr, the locomotive passes over a defective rail which causes the right hand wheel to fall 12 mm and rise again in a total time of 0.1 s, the vertical motion of the wheel being SHM. Find the maximum gyroscopic couple. b) Describe gyroscopic effect on sea vessels. c) What makes the rider of a two wheeler tilt to one side while taking a turn?	10 05 05	1	3	4.2.2
Q3	a) Derive an expression for power and effort of the governor. b) The length of upper and lower arms of a porter governor are 20 cm and 25 cm respectively. Both the arms are pivoted on the axis of rotation. The central load is 150 N, the weight of each ball is 20 N and the friction of the sleeve together with the resistance of the operating gear is an equivalent of a force of 30 N at the sleeve. If the limiting inclinations of the upper arms to the vertical are 30^0 and 40^0, determine the range of speed of the governor.	10 10	1	3	3.4.1
Q4	a) Derive an expression for the natural frequency of free transverse and longitudinal vibrations by equilibrium method.	10		4	3.1.1

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)

Munshi Nagar, Andheri (W) Mumbai – 400058

RE- EXAMINATION MARCH 2022

	b) Explain the terms under damping, critical damping and over damping. c) What are the elements of a vibratory system?	05 05	3,4		
Q5	a) The four masses m_1, m_2 and m_3 and m_4 having their radii of rotation as 200 mm, 150 mm, 250 mm and 300 mm are 200 kg, 300 kg, 240 kg and 260 kg in magnitude respectively. Find the position and magnitude of the balance mass required, if its radius of rotation is 200 mm. b) In an epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 rpm in the anticlockwise direction about the center of the gear A which is fixed, determine the speed of gear B. If the gear A instead of being fixed, makes 300 rpm in the clockwise direction, what will be the speed of gear B?	10 10	1,2	3	4.2.2

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)

Munshi Nagar, Andheri (W) Mumbai – 400058

ODD SEM RE- END-SEM-EXAMINATIONS MAR 2022

Program: BTech Mechanical engg

Duration: 3 hr

Maximum Points: 100

Course Code: PE-BTM511

Course Name: Finite Element Methods for Mechanical Engineers.

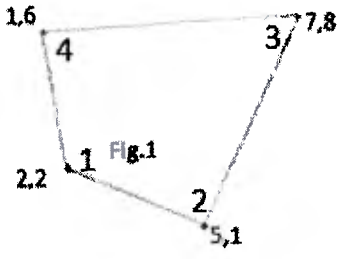
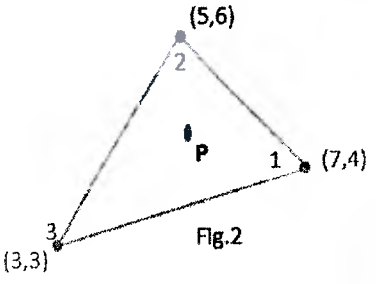
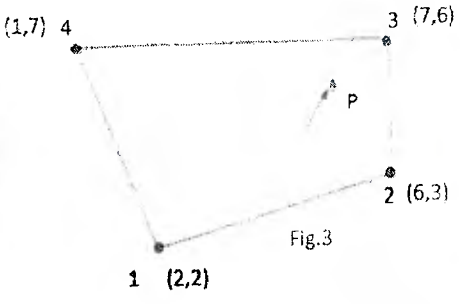
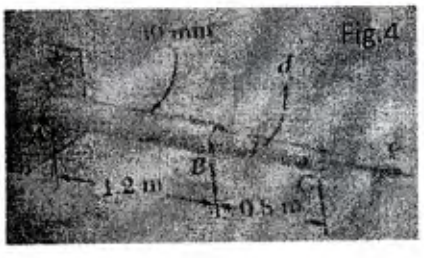
Semester: V

Notes:

1. Question No. 1 is compulsory
2. Solve any four out of remaining six.
3. Answers to each sub-questions are grouped together
4. Use of scientific calculator is allowed
5. Begin answer to each question on new page.
6. Keep some margin on left side of answer paper
7. **Candidates should write the answer legibly**

==========

Q. no.	Description	Points
1	Answer the following: a) Describe the Galerkin Weighted residual method. b) What do you meant by Jacobian Matrix? Explain. c) Explain step-by-step process of FEA. d) What are the characteristics of the stiffness matrix	5x4
2	In the element shown in Fig.3 *P* is the point (4, 4). On this point the load of 12 kN in the directions of 45 degrees with horizontal is applied. Determine its nodal equivalent forces.	20
3	For the stepped bar shown in fig.4, obtain the nodal displacement and stress in each element using FEA. Take d= 20 mm and P=60 kN. E= 100 GPa.	20
4	a) Obtain the shape functions for triangular element (fig.2) b) For the three-noded triangular element shown in fig.2, calculate temperature at point P(6,4). Given the nodal temperatures $T_1 = 60^0$ C, $T_2 = 90^0$ C, $T_3 = 120^0$ C. c) For the three-noded triangular element shown in fig.2, calculate displacement at point P(5,5). Given $u_1=2$, $u_2=3$, $u_3=5$; $v_1=1$, $v_2=2$, $v_3=3$.	10 5 5

5	a) Find the Jacobian Matrix for the element shown in fig.1 b) Derive the expression of weak formulation for two noded bar element	15 5
6	a) Define the Jacobian . b) What are the advantages of use of natural coordinates in FEA? c) What are the advantages and dis-advantages of FEM? d) Obtain shape function for quadratic bar element using Lagrangian method.	4 6 6 4
7	a) Discuss Gauss quadrature technique of numerical integration. b) Discuss field of applications of FEM c) Discuss transformation matrix for Arbitrary oriented bar element	8 6 6
	 Fig.1  Fig.2	
	 Fig.3  Fig.4	

T. Y. B. Tech (Mech) Sem V

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058.

Re Exam, Jan 2022

Date 14-03-2022 **Max. Points:100**

Total Duration :3 hrs **Program: BTech Mechanical Third Year**

SEM V

Name of the Course: LGM **Course Code :PE-BTM534**

Instructions:

- **Solve any 5 questions**
- **Draw neat diagrams**

Lean & Green Manufacturing

Que. No	Question Statement	Max. points	CO	Module
Q1A	Explore the Lean Barriers for Product Development. State the Action points to eliminate the Lean Barriers.	10	CO1	M1
Q1B	What are the various means of achieving poka yoke? Explore poka yoke concept for various activities in SPCE Campus.	10	CO1, CO2	M5
Q2A	Explain the Guidelines for Design for Environment Friendly Product.	10	CO4	M1, M4
Q2B	Identify and illustrate wastes minimization opportunities in SPCE Library.	10	CO2	M2, M3
Q3A	Draw the Ishikawa diagram to showcase the Waste Minimization Opportunities (under the various categories) for SPCE Hostel/ SPCE Mess. State the Key performance parametres.	10	CO2	M2, M3
Q3B	Draw the Ishikawa diagram to showcase Causes for poor Overall Equipment Effectiveness in Manufacturing organisation.	10	CO2	M3
Q4A	Explore the Lean Green Practices that can be adopted in manufacturing of Electric Vehicles. State the strategies to overcome limitations of Lean Green Practice bundles.	10	CO4	M4, M6
Q4B	Develop the strategies to reduce the wastes in state transport in Maharashtra.	10	CO1, CO2	M2
Q5A	State the Characteristics of Lean and Green Enterprise. Develop the Roadmap to convert Mumbai Local Train service Organisation into the Lean and Green Enterprise.	10	CO3, CO4	M6, M7
Q5B	Explore stakeholders and their requirements in the process of Admission to BTech programme. Showcase use of Value stream Mapping to create the improved process concerned with Admission to BTech programme (starting point-looking for Good Govt. Institute, End point-Admission done)	10	CO1, CO2, CO3	M2, M3
Q6A	Develop the strategies to involve the stakeholders in Green Supply Chain Management. State the capabilities of Blockchain and IOT to improve the effectiveness of Green Supply Chain.	10	CO2, CO4	M4, M7
Q6B	Carry out the life cycle analysis of Water cooler. State the important assumptions, input variables, output variables.	10	CO4	M4, M6
Q7A	Explore the guidelines for Human Development for sustainable Lean implementation.	10	CO1, CO2, CO3	M5,M6
Q7B	Discuss the concepts and benefits of 5S. State the principles adopted in 5S. Prepare the 5S audit checksheet.	10	CO3	M5, M6