



17/5/22

Bharatiya Vidya Bhavan's
SARDAR PATEL COLLEGE OF ENGINEERING

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



Final ~~year~~ B.Tech (Mech) Sem VIII

END SEMESTER - EVEN SEM - MAY 2022

Program: B.Tech. in Mechanical Engg.

Duration: 3 Hour

Course Code: PE-BTM711

Max. Points: 100

Course Name: Process Equipment Design & Piping Engineering

Semester: VIII

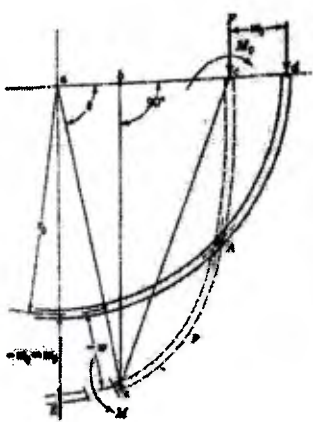
Notes:

1. Question no. 1 is compulsory. Solve any 4 of the remaining 6 questions.
2. Refer annexure for additional information. Assume suitable data if necessary.
3. 'x' is the single last digit (0 to 9) of student's registration no. in questions marked with *.

Q. No.	Questions	Points	CO	BL	PI
Q1 COMPULSORY	A) Discuss various considerations which an engineer must consider while preparing a material ordering specification. Apply these considerations to develop a specification for an 80 thick carbon steel plate which will be used to hot roll shells of 2000 mm inside diameter and 20 meters total length for a critical vessel. The vessel will be occasionally exposed to very low temperatures.	(5)	1	2	3.1.4
	B) * A pressure vessel has a hemispherical dished end of inside diameter $(2000 + 10 \times x)$ mm and 40 mm minimum thickness. Calculate the MAWP of the dished end. Weld joint efficiency is 0.9, corrosion allowance is 3 mm, allowable stress is 100 MPa and hot forming allowance is 4 mm.	(5)	2	3	2.4.2
	C) You along with your team members have performed the finite element method based stress analysis of certain discontinuity regions of a pressure vessel using ASME code. Describe the steps taken by you to perform the plastic collapse check at the discontinuities. Recommend 3 guidelines for future teams, based on your experience which will reduce the efforts and time to perform such an analysis.	(5)	3	4	3.2.3
	D) * A 550 NB process pipe is subjected to internal design pressure of $(2.5 + 0.1 \times x)$ MPa and has a design temperature of 525°C. The pipe material is seamless carbon steel with allowable stress of 35 MPa. Corrosion allowance is 3 mm. Factor $W = 1.0$ for $T < 510^\circ\text{C}$ and $W = 0.5$ for $T > 815^\circ\text{C}$. Calculate required schedule of the pipe.	(5)	3	3	2.1.3
Q2	A) Describe the significance of process diagrams BFD, PFD, and P&ID in the design of a process plant. Explain any 3 guidelines for the development of a good plant layout.	(5)	1	3	2.1.3
	B) * A carbon steel reactor vessel has a shell of $(1200 + 10 \times x)$ mm inside diameter, 't' thickness, and 5000 mm unsupported length. The	(10)	3	4	3.2.2

	<p>shell is subjected to external pressure of 0.10 MPa at 370° C due to process conditions. Calculate the required thickness 't' of the shell. Also, calculate the size of the stiffeners. Corrosion allowance is zero.</p> <p>C) Describe different types of flanges and flange facings with a neat sketch. Recommend suitable applications for each type of flange/facing.</p>	(5)	2	2	2.1.2						
Q3	<p>A) * Design a flange with a flat face as per the following data.</p> <table><tr><td>Design pressure = $(3 + 0.1 \times x)$ MPa</td><td>Flange inside diameter= 1000 mm</td></tr><tr><td>Allowable flange stress = 250 MPa</td><td>Gasket = flexible ($m=2.75$, $y= 40$ MPa)</td></tr><tr><td colspan="2">Allowable bolt stress: operating =180 MPa, gasket seating condition = 200 MPa</td></tr></table> <p>B) * Figure shows pipeline ABCDE connecting two process equipment.</p> <p>Design data is as follows.</p> <ul style="list-style-type: none">• Pipe size: 500 NB sch STD; Pipe material: SA106 Gr B; Elbows: SR type• Allowable stress (cold/hot) = 130/120 MPa; Modulus of elasticity = 200,000 MPa, Corrosion allowance = nil• Thermal expansion at operating temperature = 2.5 mm/m• Suggested maximum span between supports = $(40+x)$ m• Displacement at point A in x,y,z directions = +1, -1, +1 mm• Displacement at point E in x,y,z directions = 0, 0, 0 mm <p>(i) Write a short note on different types of piping supports and guidelines to locate these.</p> <p>(ii) Select suitable locations for support H1, H2, and H3.</p> <p>(iii) Check the need for performing flexibility analysis. Consider factor $K1 = 208300S_A/E_a$</p>	Design pressure = $(3 + 0.1 \times x)$ MPa	Flange inside diameter= 1000 mm	Allowable flange stress = 250 MPa	Gasket = flexible ($m=2.75$, $y= 40$ MPa)	Allowable bolt stress: operating =180 MPa, gasket seating condition = 200 MPa		(10)	3	4	2.4.2
Design pressure = $(3 + 0.1 \times x)$ MPa	Flange inside diameter= 1000 mm										
Allowable flange stress = 250 MPa	Gasket = flexible ($m=2.75$, $y= 40$ MPa)										
Allowable bolt stress: operating =180 MPa, gasket seating condition = 200 MPa											
		(10)	4	4	2.4.1						

Q4	A) The 'Piping Material Specification' is issued by EPC for a specific project. Discuss the contents of this document. How is this document used during the design phase of a project?	(5)	4	2	2.1.2
	B) Explain the importance of the following terms in the design of pressure equipment: (i) Design pressure, (ii) MDMT, (iii) Corrosion allowance, (iv) Weld joint efficiency, (v) Gasket factors m and y .	(5)	2	2	2.1.2
	C) * Design skirt support for a vertical vessel with the data given below. Determine the thickness of the skirt and base plate.	(10)	3	4	3.1.6
	Vessel ID = $(2000 + 10 \times x)$ mm	Permissible stress, skirt = 150 MPa (tension), 75 MPa (compression)			
	Vessel thickness = 12 mm				
	Skirt ID = $(2000 + 10 \times x)$ mm				
	Total height of vessel = $(40+x)$ m	Permissible bending stress, base plate = 140 MPa			
Q5	Operating weight of vessel = 3000 kN	Permissible stress, bolts = 180 MPa			
	Empty weight of vessel = 2500 kN	Permissible compressive stress, foundation = 20 MPa			
	Wind pressure, $H > 20\text{m}$ = 1800 N/m^2	Seismic factor, $C = 0.12$			
	Wind pressure, $H < 20\text{m}$ = 900 N/m^2				
	A) * A cylindrical vessel of 2000 mm ID is subjected to an internal pressure of $(3 + 0.1 \times x)$ MPa. Design the reinforcing pad for a nozzle fabricated from plate with the following data. The nozzle axis makes an angle of $(60 + x)^\circ$ with the axis of shell.	(10)	2	3	2.4.2
	Internal dia. of nozzle = 500 mm	Noz. height above vessel = 200 mm			
	Thickness of vessel = calculate and round to the nearest even integer	Permissible stress for shell and nozzle = 100 MPa			
Q6	Thk. of noz. wall = calculate and round to the nearest even integer	Corrosion allowance = 1 mm			
	B) * A 150 NB SCH 80 pipeline (168.3 mm OD, 10.97 mm nominal wall thickness) has an equivalent length of $(100 + 10 \times x)$ m for the purpose of pressure drop calculations. The pipe inside surface has a surface roughness of 0.06 mm. The fluid flowing through the pipeline has a density of $(750 + 10 \times x) \text{ kg/m}^3$, viscosity of 1.4 cP and mass flow rate of 100,000 kg/hr. Calculate the pressure drop inside the pipeline.	(5)	4	3	2.3.1
	C) Discuss different types of pipe fittings that are commonly used in pressure piping with neat sketches. Explain end types for the fittings and suggest suitability of each end type for specific applications.	(5)	4	2	2.1.2
Q6	A) State-owned Indian Oil Corporation (IOC) will be adding petrochemical and lube plants to its previously announced plan to expand crude oil processing capacity at its Koyali refinery at Vadodara in Gujarat. Describe the major engineering phases through	(5)	1	2	2.1.3

	<p>which such a project will progress till its completion. Highlight the role of EPC organization in these phases.</p> <p>B) The radial deformation w of a quarter section of cylinder subjected to external pressure is obtained as follows.</p> $w = A \sin q\theta + B \cos q\theta + K$ <p>where K is constant and $q^2 = (1 + \frac{pr_0^3}{EI})$</p> <p>Apply the symmetry boundary conditions and prove that the critical buckling pressure is given by $\frac{3EI}{r_0^3}$.</p>		(5)	2	4	2.4.1							
	<p>C) * A single pass fixed-tubesheet heat exchanger has following specification.</p> <table><tr><td>Number of tubes = $(300 + 10 \times x)$</td><td>Outside dia. of tubes = 20 mm</td></tr><tr><td>Tube side design pressure = 2.0 MPa</td><td>Shell side design pressure = 0.5 MPa</td></tr><tr><td>Pitch = triangular</td><td>Corrosion allowance = nil</td></tr><tr><td>Allowable stress (shell/tube) = 100 MPa</td><td>Tubesheet design factor, $F = 1.0$</td></tr></table> <p>Determine the thickness of the tubesheet. Describe the design considerations involved in the heat exchanger baffle arrangement.</p>	Number of tubes = $(300 + 10 \times x)$	Outside dia. of tubes = 20 mm	Tube side design pressure = 2.0 MPa	Shell side design pressure = 0.5 MPa	Pitch = triangular	Corrosion allowance = nil	Allowable stress (shell/tube) = 100 MPa	Tubesheet design factor, $F = 1.0$	(10)	3	4	2.4.1
Number of tubes = $(300 + 10 \times x)$	Outside dia. of tubes = 20 mm												
Tube side design pressure = 2.0 MPa	Shell side design pressure = 0.5 MPa												
Pitch = triangular	Corrosion allowance = nil												
Allowable stress (shell/tube) = 100 MPa	Tubesheet design factor, $F = 1.0$												
Q7	A) The process equipment are subjected to different types of loadings which need to be addressed during the design stage. Discuss the differences in the nature of these loadings.	(5)	1	2	2.1.2								
	B) Explain the role played by fabrication processes and the inspection and testing techniques in the design of pressure equipment.	(5)	1	2	2.1.2								
	C) Discuss the purpose of piping flexibility analysis and explain the load cases and the basic methodology prescribed by design code for such analysis. Define following terms: (i) flexibility factor, (ii) stress intensification factor.	(5)	4	2	2.1.2								
	D) * Select a variable spring support from the catalogue (Annexure I) for a location where operating load is $(600 + 10 \times x)$ N and the total movement of pipe is 10 mm downwards.	(5)	4	3	2.3.1								

ANNEXURE I

Pipe Schedule

NPS inches	N.D.	O.D. mm	10	20	30	STD	40	60	XS	80	100	120	140	160
20	500	508	6.35	9.53	12.70	9.52	15.08	20.62	12.7	26.19	32.54	38.1	44.45	50.01
22	550	558.8	6.35	9.53	12.70	9.52	15.87	22.22	12.7	28.57	34.92	41.27	47.62	53.97
24	600	609.6	6.35	9.53	12.70	9.52	17.47	24.61	12.7	30.96	38.89	46.02	52.37	59.54

Factor Y

Materials	Temperature, °C (°F)					
	≤ 482 (900 & Lower)	510 (950)	538 (1000)	566 (1050)	593 (1100)	≥ 621 (1150 & Up)
Ferritic steels	0.4	0.5	0.7	0.7	0.7	0.7
Austenitic steels	0.4	0.4	0.4	0.4	0.5	0.7

Useful expressions for tubesheet design

$$D_{bundle} \approx d_0 \left(\frac{N_t}{0.319} \right)^{1/2.142}$$

Useful expressions for support skirt design against wind and seismic load

$T = 6.35 \times 10^{-5} (H/D)^{1.5} (W/t)^{0.5}$ where W is in kN; wind load $P = k_1 k_2 p H D_0$, wind shape factor $k_1 = 0.7$ to 0.85 , wind factor related to period, $k_2 = 1$ if $T < 0.5$ sec, else $k_2 = 2$

Flange Design:

$$\frac{d_o}{d_i} = \sqrt{\frac{y-pm}{y-p(m+1)}}; W_{m1} = \frac{\pi}{4} G^2 p + 2b\pi Gmp; W_{m2} = \pi b G y; t = 0.72 \sqrt{\frac{MY}{Bf_{allow}}}$$

$$Y = \frac{1}{K-1} \left[0.66845 + 5.71690 \frac{K^2 \log_{10} K}{K^2 - 1} \right], K = A/B$$

Pressure Drop Calculations

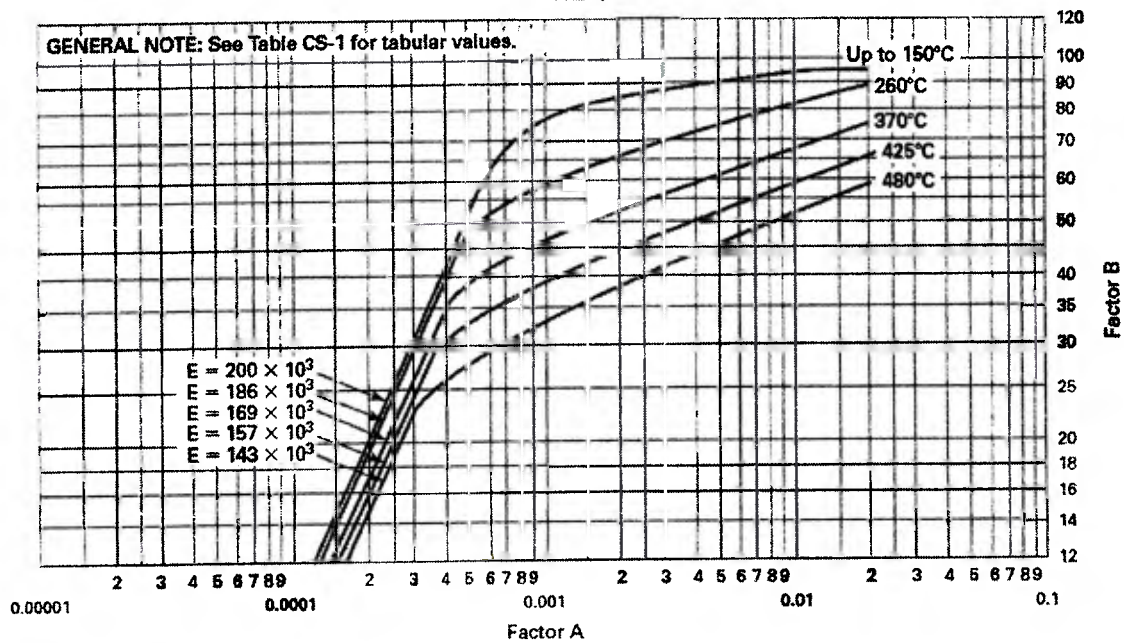
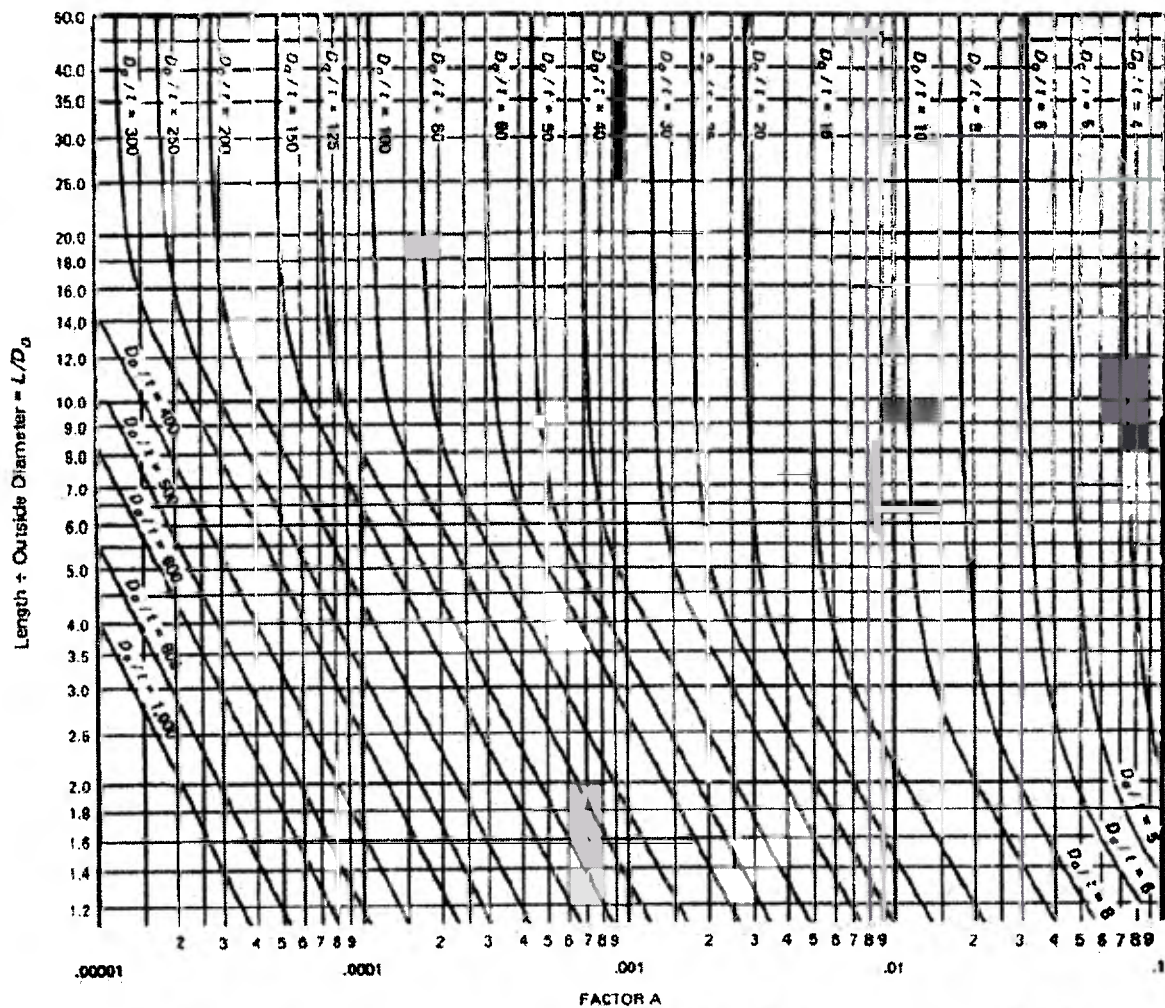
Colebrook White equation: $\frac{1}{\sqrt{f_D}} = -2 \log_{10} \left(\frac{e}{3.7D} + \frac{2.51}{Re \sqrt{f_D}} \right)$

Variable Spring Support Catalogue

Table of dimensions VS1, VS2, VS3.

Series			Hanger size						
VS3	VS2	VS1	0	1	2	3	4	5	6
Travel in mm			Load Capacity in Kgs.						
20	10	5	11.12	19.68	25.33	32.45	44.45	59.2	78.5
12	6	3	11.77	20.83	26.9	34.59	47.27	63	83.5
4	2	1	12.42	21.98	28.47	36.73	50.09	66.7	88.5
0	0	0	12.74	22.56	29.26	37.8	51.5	68.6	91
8	4	2	13.39	23.71	30.83	39.94	54.32	72.4	96
16	8	4	14.04	24.86	32.4	42.08	57.14	76.1	101
24	12	6	14.68	26.01	33.97	44.22	59.96	79.9	106
32	16	8	15.33	27.16	35.54	46.36	62.78	83.6	111
40	20	10	15.98	28.31	37.11	48.5	65.6	87.4	116
48	24	12	16.63	29.46	38.68	50.64	68.42	91.2	121
56	28	14	17.28	30.61	40.25	52.78	71.24	94.9	126
64	32	16	17.92	31.76	41.82	54.92	74.08	98.7	131
72	36	18	18.57	32.91	43.39	57.06	76.88	102.4	136
80	40	20	19.22	34.06	44.96	59.2	79.7	106.2	141

External pressure design charts for carbon steel





Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

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



End Sem - May 2022 Examinations

Program: Mechanical

Duration: 3 Hrs

Course Code: BTM 733

Maximum Points: 100

Course Name: Industrial Robotics

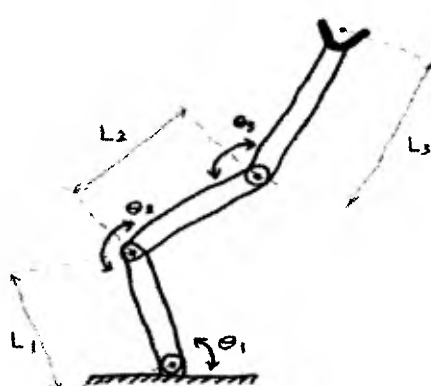
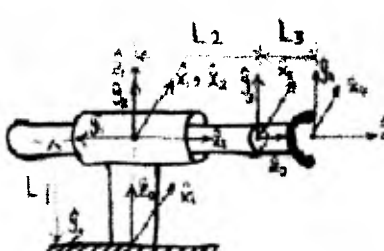
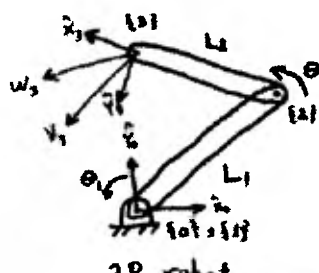
Semester: VIII

Notes: Assume suitable data whenever necessary

Solve any five

Q.N.	Questions	Pt	CO	BL	PI
1a	Explain Automation in detail and the three Laws of Robotics	10	IV	I	1.4.1
1b	Describe Artificial Intelligence [AI] and the goal of AI and Robotics. Also define Robot in eight different ways.	10	I	II	2.1.1
2a	Explain Robotic manipulator and discuss the types of Grippers with schematic	10	I	II	1.3.1
2b	Demonstrate Robot Anatomy in detail and Robot motions.	10	I	III	1.4.1
3a	Classify the Robots and explain each in brief	10	I	IV	1.4.1
3b	Explain different types of drives and types of electric motors used in robots	10	III	I	1.3.1
4a	Show different types of sensors used in Robot and discuss the factors which determine work space envelop.	10	III	III	1.3.1
4b	Categorize the types of robots with axes, joints and shape of work space also advantages / disadvantages of each.	10	III	IV	1.4.1
5a	Explain the specification of robot with precision, accuracy and encoders	10	III	I	1.4.1
5b	Develop frames {0} to {4} for the shown planar 3R (RRR) robotic manipulator ,then find the DH parameters table	10	II	VI	1.1.1

**End Sem - May 2022 Examinations**

																														
6a	<p>For the shown RPR robotic manipulator, the DH parameters table is defined as shown in figure. Create the transformation matrices 0T_1 1T_2 2T_3 3T_4 and find 0T_4</p> <table><tr><th>i</th><th>α_{i-1}</th><th>a_{i-1}</th><th>d_i</th><th>θ_i</th></tr><tr><td>1</td><td>0</td><td>0</td><td>L_1</td><td>θ_1</td></tr><tr><td>2</td><td>90</td><td>0</td><td>d_2</td><td>0</td></tr><tr><td>3</td><td>0</td><td>0</td><td>L_2</td><td>θ_3</td></tr><tr><td>4</td><td>0</td><td>0</td><td>L_3</td><td>0</td></tr></table> 	i	α_{i-1}	a_{i-1}	d_i	θ_i	1	0	0	L_1	θ_1	2	90	0	d_2	0	3	0	0	L_2	θ_3	4	0	0	L_3	0	10	II	VI	2.4.1
i	α_{i-1}	a_{i-1}	d_i	θ_i																										
1	0	0	L_1	θ_1																										
2	90	0	d_2	0																										
3	0	0	L_2	θ_3																										
4	0	0	L_3	0																										
6b	<p>Generate the jacobian using the static forces / moment method</p>	10	III	VI	2.4.1																									
7	<p>For the 2R Robot , derive the linear and angular velocities of the tool tip (end effector) based on frames {0} and {3} , then find the jacobian matrix relative to frame {0} and {3}.</p> <table><tr><th>i</th><th>α_{i-1}</th><th>a_{i-1}</th><th>d_i</th><th>θ_i</th></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>θ_1</td></tr><tr><td>2</td><td>0</td><td>L_1</td><td>0</td><td>θ_2</td></tr><tr><td>3</td><td>0</td><td>L_2</td><td>0</td><td>0</td></tr></table> 	i	α_{i-1}	a_{i-1}	d_i	θ_i	1	0	0	0	θ_1	2	0	L_1	0	θ_2	3	0	L_2	0	0	20	III	VI	2.4.1					
i	α_{i-1}	a_{i-1}	d_i	θ_i																										
1	0	0	0	θ_1																										
2	0	L_1	0	θ_2																										
3	0	L_2	0	0																										



Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

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



END SEM EXAMINATION May-2022

Program: **B. Tech. in Mechanical Engineering**

Class: **Final Year B. Tech. (Mechanical)**

Course code: **BTM 754**

Course: **Power Plant Engineering**

Date: **17 May 2022**

Duration: **3 Hr.**

Max. Points: **100**

Semester: **VIII**

Instructions:

- Attempt **ANY 05** of the following questions.
- Draw **neat Process diagrams /T-s Diagrams/ Figures** etc. wherever necessary.
- Use **Graph paper** for drawing Load curve & Load Duration curve, Hydrograph & Flow Duration Curve
- **Legible hand writing**, proper figures and tidy work carry weightage.
- Answers to the questions should be **Brief and Specific**.
- **Assume suitable data** wherever found necessary and mention the same.

Q. No	Question	Points	CO	BL	Module																				
1	<p>A) Define : i) Load Factor ii) Plant Capacity Factor iii) Plant Use Factor iv) Reserve factor and Explain: Significance of each plant performance parameter.</p> <p>B) Construct: Chronological daily Load Curve and Load Duration Curve from the following observation.</p> <table><tr><th>Time</th><th>Load, kW</th><th>Time</th><th>Load, kW</th></tr><tr><td>6 am to 8 am</td><td>3000</td><td>5 pm to 6 pm</td><td>7000</td></tr><tr><td>8 am to 12 Noon</td><td>10000</td><td>6 pm to 9 pm</td><td>6000</td></tr><tr><td>12 Noon to 1 pm</td><td>5000</td><td>9 pm to 11 pm</td><td>6000</td></tr><tr><td>1 pm to 5 pm</td><td>10000</td><td>11 pm to 6 am</td><td>2000</td></tr></table> <p>If the Reserve capacity in the station is 3000 kW, Evaluate: i) Load Factor ii) Plant Capacity Factor. Question</p>	Time	Load, kW	Time	Load, kW	6 am to 8 am	3000	5 pm to 6 pm	7000	8 am to 12 Noon	10000	6 pm to 9 pm	6000	12 Noon to 1 pm	5000	9 pm to 11 pm	6000	1 pm to 5 pm	10000	11 pm to 6 am	2000	(10)	1,4	I, II	1
Time	Load, kW	Time	Load, kW																						
6 am to 8 am	3000	5 pm to 6 pm	7000																						
8 am to 12 Noon	10000	6 pm to 9 pm	6000																						
12 Noon to 1 pm	5000	9 pm to 11 pm	6000																						
1 pm to 5 pm	10000	11 pm to 6 am	2000																						
2	<p>A) Explain:Various types of Hydroelectric Power Plants.</p> <p>B) Explain: Hydrogrph and Flow Duration Curve. The mean monthly discharge at a particular hydro plant site is given in Table below. Construct: Hydrograph and Flow duration curve.</p>	(10) (10)	2 1,2	II II, III	2 2																				

		Month	Discharge, m ³ /s	Month	Discharge, m ³ /s				
		January	200	July	2000				
		February	450	August	2400				
		March	600	September	1800				
		April	1200	October	1200				
		May	1500	November	800				
		June	1600	December	400				
3	A) Compare: Advantages and disadvantages of Diesel Power Plant over Gas Turbine Power Plants. B) Following parameters are noted for a performance test of a single cylinder four stroke diesel engine:- Brake load applied to drum of 1.8 m diameter is 196 N. Fuel consumption is 0.12 kg/min with calorific value of 41870 kJ/kg. Total amount of cooling water passing through the jacket is 540 kg with its inlet and outlet temperatures as 20 °C and 60 °C respectively. Total amount of air consumed is 6.1 kg/min. The exhaust gases having $C_p = 1.005 \text{ kJ/kg.K}$ leaving the engine cylinder at 300 °C are released to atmosphere at 20 °C. i) Evaluate: Brake Power and Thermal Efficiency of the engine. ii) Estimate: Heat Balance of the engine.	(10)	2	V	5				
		(10)	2,4	V	5				
4	A) Discuss: Criterion for classification and State: Types of Nuclear Power Plants based on these criteria. B) Explain: Working, advantages and disadvantages of Pressurised Water Reactor (PWR) with a neat sketch.	(10)	2	V	4				
		(10)	2,4	II	4				
5	A) Explain: Working, advantages and disadvantages of Modified Open Gas Turbine Cycle (OGTC) Plant with regeneration, intercooling and reheating. Draw: a neat system diagram and T-s Diagram. B) An Open Gas Turbine Cycle (OGTC) plant operating on air standard Brayton cycle uses a regenerator with 75% effectiveness. Air at Compressor Inlet is at 01 MPa, 30°C with a pressure ratio = 6 and Maximum Temperature of cycle = 900 °C, Assume Compressor and Turbine efficiency = 100 %, for working medium air, $C_p = 1.005 \text{ kJ/kg.K}$ and $\gamma = 1.4$. Evaluate: Thermal Efficiency of plant. Draw: System diagram and T-s diagram.	(10)	2	I, II	5				
		(10)	2,4	I, V	5				
6	A) Explain: Concept of Fluidized Bed Combustion. Describe: Arrangement and Working of any one Fluidised Bed Combustor with neat sketch.	(10)	2	II, V	3				



Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)

Munshi Nagar, Andheri (W) Mumbai - 400058



Final yr. B.Tech (Mech) Sem VIII
END SEMESTER EXAMINATION MAY 2022

19/5/22

Program: Mechanical Engineering

Duration: 3 hour

Course Code: PE-BTM 755

Maximum Points: 100

Course Name: Automobile Engineering

Semester: VIII

INSTRUCTIONS:

1. Attempt any five questions out of six questions.
2. Draw neat schematic diagrams wherever is necessary, **highlight** important points of answer.
3. Assume suitable data if necessary and mention it.

Q.No.	Questions	Points	CO	BL	PI
Q1 A)	A ladder chassis system tested and found to be poor in stability of vehicle while steering and moving on grade. Suggest separate solutions to solve these problems using sketch? Give classification of buses based on their body shapes?	10	1	3	1.2.1
B)	Give working principle of working of flash light indicator with the help of neat sketch? What are the issues associated with controlled operation of wiper?	10	3	2	2.1.2
Q2 A)	Give working principle of Battery or Coil Ignition System with the help of neat sketch? Write short note on battery capacity rating?	10	3	1	1.2.2
B)	Derive final expression for thermal efficiency of diesel air standard cycle with the help of necessary P-V and T-S diagram? With the help of figure give criteria for selecting maximum possible range of speed for an automobile, when it's running on the level road?	10	2	1	1.2.1
Q3 A)	a) Estimate torque transmission capability by a two plate clutch, which is having average radius of 15 cm and it is coated using organic material (having coefficient of friction as 0.35)? After release of clutch pedal, spring assembly applies 50 N of axial load on the clutch plate. Also estimate (all inertia loads are negligible and wheels rides without any slip) tractive effort available at road-tyre interface if $N_{t1} = 0.5$, $N_d = 0.5$, mean wheel radius = 0.2 meters? b) Obtain expression for maximum tractive effort available in	10	1	3	2.1.1



Bharatiya Vidy Bhavan's
SARDAR PATEL COLLEGE OF ENGINEERING

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



END SEMESTER EXAMINATION MAY 2022

	case of front wheel drive and rear wheel drive?				
B)	Why disk brake performance is more reliable compared to drum brake performance? Explain it with the help of sketch? Define coefficient of friction sensitivity, brake fade of friction brakes? Write short note on traction limit, friction ellipse and draw graph between friction coefficient and wheel slip ratio, give its significance?	10	2	2	2.2.1
Q4 A)	Enlist components of tyre and discuss? With the help of neat sketch write short note on "Double wishbone suspension" system?	10	3	1	1.2.2
B)	a) A car has pivot pins 137 cm apart, length of each track arm is 18 cm and track rod length 127 cm, is behind the front axle. Determine wheel base which will give true rolling for all wheels, when the car is turning so that input steering angle to inner wheel is 30° ? b) Calculate torque required to obtain rack force of 20 N, if C factor is 0.05 mm/degree, motion transmission efficiency at gear box is half.	10	1	3	1.1.2
Q5 A)	Obtain final expression for equivalent weight of automobile; when it is accelerated through acceleration 'f' (consider inertia of slow and fast moving parts)?	10	1	2	2.1.2
B)	Explain working principle of hydraulic brake system with neat sketch generally used in heavy vehicle. Show all brake subsystem and its components?	10	3	2	1.2.2
Q6 A)	Explain how gear shift can be made smooth and reliable? In gear shifting with 5 stage gear box, draw graph between wheel speeds versus vehicle longitudinal speed? List down functions of suspension system and challenges for its design?	10	4	3	1.1
B)	Write short note on i) camber, ii) caster and iii) toe with respect to wheel alignment? Give ideal and real prime mover characteristic with the help of necessary sketch? Give its physical significance?	10	2	1	1.2.2



Bharatiya Vidya Bhavan's
SARDAR PATEL COLLEGE OF ENGINEERING

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



A. P. (M. T. C.) Sem VIII
END SEMESTER RE-EXAMINATION JULY 2022

Program: Mechanical Engineering

Duration: 3 hour

Course Code: PE-BTM 755

Maximum Points: 100

Course Name: Automobile Engineering

Semester: VIII

INSTRUCTIONS:

11/7/22

1. Attempt any five questions out of six questions.
2. Draw neat schematic diagrams wherever is necessary, highlight important points of answer.
3. Assume suitable data if necessary and mention it.

Q.No	Questions	Point s	C O	B L	PI
Q1 A)	Give classification of buses based on their body shapes? List down various loads acting on the automobile frame?	10	1	3	1.2. 1
B)	Obtain expression for maximum tractive effort available in case of front wheel drive and rear wheel drive?	10	3	2	2.1. 2
Q2 A)	Write short note on i) camber, ii) caster and iii) toe with respect to wheel alignment? Give ideal and real prime mover characteristic with the help of necessary sketch? Give its physical significance?	10	3	1	1.2. 2
B)	With the help of figure give criteria for selecting maximum possible range of speed for an automobile, when it's running on the level road? Derive final expression for thermal efficiency of petrol/otto air standard cycle with the help of necessary P-V and T-S diagram?	10	2	1	1.2. 1
Q3 A)	a) A car has pivot pins 159 cm apart, length of each track arm is 21 cm and track rod length 139 cm, is behind the front axle. Determine wheel base which will give true rolling for all wheels, when the car is turning so that input steering angle to inner wheel is 25°? b) Calculate torque required to obtain rack force of 25 N, if C factor is 0.05 mm/degree, motion transmission efficiency at gear box is half?	10	1	3	2.1. 1



Bharatiya Vidya Bhavan's
SARDAR PATEL COLLEGE OF ENGINEERING

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



END SEMESTER RE-EXAMINATION JULY 2022

B)	Give significance of friction ellipse and draw graph between friction coefficient and wheel slip ratio, give its significance? Why disk brake performance is more reliable compared to drum brake performance? Explain it with the help of sketch? Define coefficient of friction sensitivity, brake fade of friction brakes?	10	2	2	2.2. 1
Q4 A)	With the help of a neat sketch, write a short note on the "Air suspension" system? Enlist components of tyre and discuss?	10	3	1	1.2. 2
B)	Estimate torque transmission capability by a two plate clutch, which is having average radius of 15 cm and it is coated using organic material (having coefficient of friction as 0.35)? After release of the clutch pedal, spring assembly applies 50 N of axial load on the clutch plate. Also estimate (all inertia loads are negligible and wheels rides without any slip) tractive effort available at road-tyre interface if $N_{H1} = 0.5$, $N_d = 0.5$, mean wheel radius = 0.2 meters	10	1	3	1.1. 2
Q5 A)	Obtain final expression for equivalent weight of automobile; when it is accelerated through acceleration 'f' (consider inertia of slow and fast moving parts)?	10	1	2	2.1. 2
B)	Explain working principle of hydraulic brake system with neat sketch generally used in heavy vehicle. Show all brake subsystem and its components?	10	3	2	1.2. 2
Q6 A)	List down functions of suspension system and challenges for its design? Explain how gear shift can be made smooth and reliable? In gear shifting with 5 stage gear box, draw graph between wheel speeds versus vehicle longitudinal speed?	10	4	3	2.1. 1
B)	Give the working principle of Battery or Coil Ignition System with the help of a neat sketch? Write a short note on battery capacity rating?	10	2	1	1.2. 2



Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)

Munshi Nagar, Andheri (W) Mumbai - 400058



Final Year B.Tech in Mechanical Engineering
END SEM EXAM MAY 2022

DATE 18-05-2022

Class : Final Year B.Tech.in Mechanical Engineering

SESSION:MORNING

Course Name & Code- Supply Chain Management(PE-BTM734)

Semester : VIII

Total Points 100

Time Allotted : 3hour

NB.

- 1.Que 1 is compulsory
- 2.Solve any 4 questions from remaining .
- 3.Assume Suitable Data wherever required

Q. NO	Question Statement	Points	Module	CO
Q1	Explore the salient features of the SCM model for Electric Vehicle Manufacturing industry. (Explanation should cover model of supply chain, supply chain players, flows of supply chain, customer order cycle, replenishment cycle, purchasing cycle, product design, packaging, transportation, warehousing, Use of RFID and Barcode, CPFR, Forecasting techniques, VMI, outsourcing, costing/ pricing issues, Reverse logistics, Supply Chain Performance Measurement) Consider the effects of Globalization of business, privatization and Liberalization of the economy. Suggest your creative ideas.	20	M1, M2, M3, M4, M5, M6, M7	CO1 CO3
Q2A	The annual demand for a product is 64000 units. The buying cost per order is Rs10 and the estimated cost of carrying one unit in stock for a year is 20 percent. The normal price of the product is rs 10 per unit. However a supplier offers a quantity discount of 2 percent on an order of at least 1000 units at a time and a discount of 5 percent on an order of at least 5000 units. Suggest the most economic purchase quantity per order. Draw an Ishikawa Diagram to show the at least 20 causes of High inventory cost.	10	M3	CO2
Q2B	Explore the possibilities of using Industry 4.0 technologies across the entire supply chain of Electric Vehicle Manufacturing Company. Prepare the following table Name of Technology / Capability of Technology / Name Function across the supply chain / Impact of Technology on this function. Technologies may include IOT, IIOT, Simulation, Blockchain, Cloud Computing, Big Data Analytics, Artificial Intelligence, Machine Learning, Deep Learning, Augmented Reality, Virtual Reality, Cyber Security	10	M6	CO4

Q3A

New Autotech company [NAC] manufactures automobile components and supplies to 5 esteemed auto companies in South Asia. NAC evaluates its suppliers on variety of criteria as follows.

[10]

Sr.No.	Criterion	Weight
1.	Quality	20
2.	Price	25
3.	Credit facility	15
4.	Adherence to delivery schedule	15
5.	Service Facility	10
6.	Lead time	10
7.	Response to suggestions %	5

NAC has four suppliers for its one of the major supplies. Refer the following data and select the best supplier.

Sr No.	Factor	Suppliers			
		A	B	C	D
1.	Quantity supplied	85	80	90	85
2.	Quantity accepted	75	70	78	74
3.	Price per unit	20	25	22	23
4.	Credit facilities in days	15	20	30	30
5.	Delivery promised in weeks	6	6	6	6
6.	Delivery made in weeks	8	6	7.2	6
7.	Service facilities Evaluation %	80	85	75	70
8.	Lead time in week	2.5	2	3	2
9.	Response to suggestions %	82	88	85	90

State the guidelines for improving Supplier Relationship.

Q3B

Potential locations A,B, and C have the cost structure as shown in table. The product is expected to sell at Rs. 120 per unit. Find the most economical location for an expected volume of 2200 units/year.

Locations	Fixed cost per year	Variable cost per unit
A	Rs. 30000	Rs.60
B	Rs.60000	Rs.30
C	Rs.90000	Rs.20

Also determine the range of annual volume of production for which, each of the location A, B and C would be most convenient.

State the Factors affecting the location of a Manufacturing plant of Packaged Drinking Water.

Q4A

Several Automobile showrooms are located according to following grid, which represents coordinate locations of each showroom. What is the best location of New mobile warehouse considering only

10

M3

CO1,
CO2,
CO3

10

M2

CO2,
CO1

10

M2

CO1
CO2

distance and quantity sold.

SN	SHOWROOM LOCATION	X AXIS	Y AXIS
1	A	150	250
2	B	300	550
3	C	700	900

SN	SHOWROOM LOCATION	NUMBER OF AUTOMOBILES SOLD
1	A	1200
2	B	1500
3	C	1700

Q4B

A Bakery keeps stock of popular brand of bread Previous experience indicates the daily demand as given below.

Daily Demand	0	15	25	35	45	55
Probability	0.01	0.20	0.15	0.40	0.17	0.07

Consider the following sequence of random numbers.

48, 78, 19, 51, 56, 77, 15, 14, 68, 8

Using above sequence, simulate the demand for the next 10 days.

1. Find out the stock situation if the owner of bakery decides to make 35 breads every day. Estimate the daily average demand for the bread on the basis of simulated data

State the Applications of Simulations in Supply Chain Management
State the Limitations of Simulation Techniques

10

M2,
M3

CO1,
CO2

Q5A

Hospital	Revenue (x)	Profit (y)
1	9	0.18
2	4	0.13
3	8	0.16
4	6	0.18
5	16	0.28
6	17	0.30
7	18	0.27
8	14	0.23
9	16	0.30
10	22	0.47
11	17	0.37
12	9	0.20

10

M2, M7

CO1,
CO2

Explain Line of Best Fit used in SCM forecasting with the help of

Short Answer. State and explain the various types of error in Forecasting Techniques used in SCM.

A multi-hospital system (MHS) owns 12 hospitals. Revenues (x, or the independent variable) and profits (y, or the dependent variable) for each hospital are given below. Obtain a regression line for the data, and predict profits for a hospital with \$24 million in revenues. All figures are in millions of dollars.
State the Supply Chain Metrics and explain their significance.

Q5B

Production facility City Pi/ City demand Di	P1	P2	P3	P4	Demand of Oxygen
D1	22	24	18	28	25
D2	16	17	22	13	14
D3	24	14	27	17	18
D4	19	23	17	16	17
D5	25	18	24	19	11
Supply Capacity	18	14	23	30	85

Transportation Problem : A Oxygen production company has four production plants P1,P2,P3,P4 with production capacity of 18,14,23,30 (100') units per day of a product respectively. These units are expected to be shipped to 5 cities D1,D2,D3,D4,D5 with requirements of 25, 14, 18, 17, 11 in (100') units per day respectively. The transportation cost in Rs per unit between factories and cities are given in table. Formulate LPP to Find the Min Cost of Transportation . Use NWCM to find initial basic solution to the transportation problem. Use LCM to find initial basic solution to the transportation problem. Find percentage reduction in transportation cost.

Explain TPL MPL

Q6A

Prepare the SWOT analysis of Mumbai Metro Train Service Supply Chain.

Q6B

Prepare the PESTEL analysis of Supply Risk in JIT implementation.

Q7

Explain the following terms of Supply Chain Management

- Supply Chain Performance Metrics
- Agile Supply Chain
- CPRF
- Green Supplier Development
- Green Packaging

	B) Explain: Difference between Combined Cycle Power Generation and Combined Power Generation. Discuss: Combined Steam and Gas Turbine Power Plant operation.	(10)	2	II, V	6
7	A) State: Various gaseous emissions from thermal power plants. Explain: Methods to reduce/remove any one of them In details with neat sketch..	(10)	3	I, II	7
	B) State: Various pollutants from thermal power plants and Explain: its harmful effects on vegetation, animals, human beings and materials.	(10)	3	I, II	7



Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

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



Re-Examination July 2022

B. Tech (Mech) Sem VIII

Program: B. Tech Mechanical

Duration: 3 Hours

Course Code: PE-BTM756

Maximum Points: 100

Course Name: Renewable Energy Sources and Utilization

Semester: VIII

Instructions:

11/7/22

- 1) Question number ONE is compulsory and solve any FOUR out of remaining SIX questions.
- 2) Use of steam table, refrigeration properties table and Gamma function table is permitted.
- 3) If required assume suitable data and justify the same.

Q.No.	Questions	Points	CO	BL	Module
1(a)	Explain different types of wind turbine rotors.	5	1	1	4
1(b)	Discuss the use of selective surfaces.	5	1	1	2
1(c)	Discuss about side loss and bottom loss coefficients for liquid flat plate collectors. Write equations for these losses.	5	1	1	2
1(d)	Discuss the process of making multi-crystalline solar cell from copper indium gallium diselenide (CIGS) with neat sketch.	5	1	1	3
2(a)	Discuss about the World's production and reserves by considering followings: i) Fossil fuels ii) Water power iii) Nuclear power iv) Miscellaneous sources	08	1	1	1
2(b)	Calculate the overall loss coefficient for a flat-plate collector with one glass covers by calculation. (Without using empirical formula) Given the following data: Size of the absorber plate ($L_1 \times L_2$) : 1.9 m \times 0.9m Spacing between plate and the first glass cover (L) : 4 cm Spacing between first and the second glass cover (L) : 4 cm Plate emissivity (ϵ_p) : 0.92 Glass cover emissivity (ϵ_c) : 0.88 Collector tilt (β) : 20° Mean Plate temperature (T_{pm}) : 70°C	12	2	2	2



Bharatiya Vidya Bhavan's
SARDAR PATEL COLLEGE OF ENGINEERING

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



Re-Examination July 2022

	Ambient air temperature (T_a) : 24°C Wind speed (V_∞) : 2.5 m/s Back insulation thickness (δ_b) : 8 cm Side insulation thickness (δ_s) : 4 cm Thermal conductivity of insulation (k_i) : 0.05 W/m-K																				
3(a)	Discuss the principle of working of a solar cell in detail with neat sketch.	10	2	1	3																
3(b)	It is proposed to set-up a wind machine on SPCE building for which long-term data on wind speed is not available. In order to assess the wind potential and select suitable wind machine, a large number of discrete measurements of hourly wind speed are made over some representative days for a couple of years. The measurements yield the following values of the average wind speed and the standard deviation: $\bar{V} = 5.8$ m/s $\sigma = 3.5$ m/s Plot the annual wind speed-frequency distribution under the assumption that it is Weibull distribution.	10	2	2	4																
4(a)	Discuss the principle and working of Ocean Thermal Energy Conversion (OTEC) systems with neat schematic and T-s diagram. Outline with schematic diagram the working of open cycle OTEC system.	08	4	1	5																
4(b)	Calculate the energy content of the wind per square meter for the following situation: Location : Indore Month : July Take ρ for air = 1.20 kg/m ³ . Also calculate the actual energy available for a wind machine for which the cut-in speed is 14 km/h, the design speed is 36 km/h and the cut out speed is 90 km/h. The percentage frequency distribution of hourly wind speed is given in the table.	12	2	3	4																
<table><tr><td>Interval</td><td>July</td><td>Interval</td><td>July</td><td>Interval</td><td>July</td><td>Interval</td><td>July</td></tr><tr><td>00</td><td>2.3</td><td>10-12</td><td>3.4</td><td>22-24</td><td>9.5</td><td>34-36</td><td>3.0</td></tr></table>		Interval	July	Interval	July	Interval	July	Interval	July	00	2.3	10-12	3.4	22-24	9.5	34-36	3.0				
Interval	July	Interval	July	Interval	July	Interval	July														
00	2.3	10-12	3.4	22-24	9.5	34-36	3.0														

**Re-Examination July 2022**

	00-02	0.6	12-14	3.5	24-26	10.8	36-38	2.6				
	02-04	0.5	14-16	7.7	26-28	3.6	38-40	1.1				
	04-06	1.1	16-18	8.3	28-30	7.4	40-42	0.7				
	06-08	1.2	18-20	9.2	30-32	7.0	42-44	0.2				
	08-10	0.9	20-22	11.3	32-34	3.7						
5(a)	Explain the mechanism of hydroelectric power production. Also with a neat sketch explain various components of hydroelectric power plant. Also write about classification of hydroelectric power plants.								10	3	1	5
5(b)	Explain how a geothermal energy is a renewable energy. Also explain with neat sketch the flash steam power plant.								10	4	1	6
6(a)	Explain the downdraft biomass gasifier with neat sketch.								10	3	1	7
6(b)	Explain the method of Bio-ethanol and Bio-diesel production in detail.								10	3	1	7
7(a)	<p>A residential house has a power requirement of 400 W for 4 hours every night. It is proposed to meet the requirement by using a PV array, a battery storage system and an inverter. The whole system is over designed so that it can meet one extra night's requirement even if there has been no sunshine during the day. Calculate the number of PV modules and batteries required.</p> <p>Given: (i) Solar radiation is available for an average of six hours daily and the average hourly global radiation flux incident on the array is 650 W/m^2,</p> <p>(ii) Battery rating = 12V; 120 Ah, Depth of discharge = 0.7, Charging and discharging efficiency = 0.9</p> <p>(iii) Inverter efficiency at full load = 0.85</p> <p>(iv) Use PV module area used is 119.1 cm x 53.3 cm, use conversion efficiency of 10 per cent for given global radiation</p>								10	2	2	3
(b)	Draw neat sketch of pyranometer and explain its working.								10	1	1	1



Bharatiya Vidya Bhavan's
SARDAR PATEL COLLEGE OF ENGINEERING

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



Re-Examination July 2022

1. Relationship between Nusselt and Rayleigh numbers.

$$Nu_L = 1 ; Ra_L \cos \beta < 1708$$

$$Nu_L = 1 + 1.446 \left(1 - \frac{1708}{Ra_L \cos \beta} \right) ; 1708 < Ra_L \cos \beta < 5900$$

$$Nu_L = 0.229 (Ra_L \cos \beta)^{0.252} ; 5900 < Ra_L \cos \beta < 9.23 \times 10^4$$

$$Nu_L = 0.157 (Ra_L \cos \beta)^{0.285} ; 9.23 \times 10^4 < Ra_L \cos \beta < 10^6$$

2. Properties of dry air.

Table A 4.2 Properties of dry air at atmospheric pressure

T °C	ρ kg/m ³	C_p kJ/kg-K	$\mu \times 10^6$ N-s/m ²	k W/m-K	Pr	$\nu \times 10^6$ m ² /s
0	1.293	1.005	17.2	0.0244	0.707	13.28
10	1.247	1.005	17.7	0.0251	0.705	14.16
20	1.205	1.005	18.1	0.0259	0.703	15.06
30	1.165	1.005	18.6	0.0267	0.701	16.00
40	1.128	1.005	19.1	0.0276	0.699	16.96
50	1.093	1.005	19.6	0.0283	0.698	17.95
60	1.060	1.005	20.1	0.0290	0.696	18.97
70	1.029	1.009	20.6	0.0297	0.694	20.02
80	1.000	1.009	21.1	0.0305	0.692	21.09
90	0.972	1.009	21.5	0.0313	0.690	22.10
100	0.946	1.009	21.9	0.0321	0.688	23.13
120	0.898	1.009	22.9	0.0334	0.686	25.45
140	0.854	1.013	23.7	0.0349	0.684	27.80
160	0.815	1.017	24.5	0.0364	0.682	30.09
180	0.779	1.022	25.3	0.0378	0.681	32.49
200	0.746	1.026	26.0	0.0393	0.680	34.85
250	0.674	1.038	27.4	0.0427	0.677	40.61
300	0.615	1.047	29.7	0.0461	0.674	48.33
350	0.566	1.059	31.4	0.0491	0.676	55.46
400	0.524	1.068	33.0	0.0521	0.678	63.09
500	0.456	1.093	36.2	0.0575	0.687	79.38
600	0.404	1.114	39.1	0.0622	0.699	96.89
700	0.362	1.135	41.8	0.0671	0.706	115.4
800	0.329	1.156	44.3	0.0718	0.713	134.8
900	0.301	1.172	46.7	0.0763	0.717	155.1
1000	0.277	1.185	49.0	0.0807	0.719	177.1



Bharatiya Vidya Bhavan's SARDAR PATEL COLLEGE OF ENGINEERING

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



Re-Examination July 2022

Gamma Function Table For (1Sp52)

p	$\Gamma(p)$	p	$\Gamma(p)$	p	$\Gamma(p)$	p	$\Gamma(p)$
1.00000	1.00000	1.25000	0.90640	1.50000	0.88623	1.75000	0.91906
1.01000	0.99433	1.26000	0.90240	1.51000	0.88659	1.76000	0.92137
1.02000	0.98884	1.27000	0.90250	1.52000	0.88704	1.77000	0.92376
1.03000	0.98358	1.28000	0.90072	1.53000	0.88757	1.78000	0.92624
1.04000	0.97844	1.29000	0.89904	1.54000	0.88818	1.79000	0.92877
1.05000	0.97350	1.30000	0.89747	1.55000	0.88887	1.80000	0.93138
1.06000	0.96874	1.31000	0.89600	1.56000	0.88964	1.81000	0.93408
1.07000	0.96415	1.32000	0.89464	1.57000	0.89049	1.82000	0.93685
1.08000	0.95973	1.33000	0.89338	1.58000	0.89142	1.83000	0.93969
1.09000	0.95546	1.34000	0.89222	1.59000	0.89243	1.84000	0.94260
1.10000	0.95135	1.35000	0.89115	1.60000	0.89352	1.85000	0.94561
1.11000	0.94740	1.36000	0.89018	1.61000	0.89468	1.86000	0.94869
1.12000	0.94359	1.37000	0.88931	1.62000	0.89592	1.87000	0.95184
1.13000	0.93993	1.38000	0.88854	1.63000	0.89724	1.88000	0.95507
1.14000	0.93642	1.39000	0.88785	1.64000	0.89864	1.89000	0.95838
1.15000	0.93304	1.40000	0.88726	1.65000	0.90012	1.90000	0.96177
1.16000	0.92980	1.41000	0.88676	1.66000	0.90167	1.91000	0.96520
1.17000	0.92670	1.42000	0.88636	1.67000	0.90330	1.92000	0.96877
1.18000	0.92373	1.43000	0.88604	1.68000	0.90500	1.93000	0.97240
1.19000	0.92089	1.44000	0.88581	1.69000	0.90678	1.94000	0.97610
1.20000	0.91817	1.45000	0.88566	1.70000	0.90864	1.95000	0.97988
1.21000	0.91558	1.46000	0.88560	1.71000	0.91057	1.96000	0.98374
1.22000	0.91311	1.47000	0.88563	1.72000	0.91258	1.97000	0.98768
1.23000	0.91075	1.48000	0.88575	1.73000	0.91467	1.98000	0.99171
1.24000	0.90852	1.49000	0.88595	1.74000	0.91683	1.99000	0.99581
1.25000	0.90640	1.50000	0.88623	1.75000	0.91906	2.00000	1.00000



Bharatiya Vidya Bhavan's SARDAR PATEL COLLEGE OF ENGINEERING

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

End Semester Examination May 2022



19/5/22

Program: B. Tech Mechanical

Course Code: PE-BTM756

Course Name: Renewable Energy Sources and Utilization

Duration: 3 Hours

Maximum Points: 100

Semester: VIII

Instructions:

- 1) Question number ONE is compulsory and solve any FOUR out of remaining SIX questions.
- 2) Use of steam table, refrigeration properties table and Gamma function table is permitted.
- 3) Assume suitable data and justify the same.

Q.No	Questions	Points	CO	BL	PI
1(a)	Compare about Worlds and India's production and reserves of wind energy sources.	05	CO1	1	1.4.1
1(b)	Explain the working principle of photovoltaic solar cell.	05	CO1	3	1.4.1
1(c)	A geothermal aquifer supplies hot water with wellhead temperature of 75°C at the flow rate of 30 liters/sec. The heat energy is used to supplement the direct heating unit above datum temperature of 40°C. If the geothermal heat is used for 170 days each year, how much oil is saved annually if the overall combustion efficiency of oil burner is 75%. Assume the heat of combustion of oil is 4.184×10^7 kJ/tonnes	05	CO4	3	2.4.1
1(d)	A mountain stream flows over a terrain where micro-hydro power plant is possible where an effective head of 70 m be built and a flow rate of $0.6 \text{ m}^3/\text{s}$ can be maintained how much power can the hydro power plant can generate and what population can be supported by this energy, if the per capita electricity consumption in India is 780 kWh annually. Assume plant efficiency (η) of 80 percent.	05	CO3	3	2.4.1
2(a)	Calculate the overall loss coefficient for a flat-plate collector with one glass covers by calculation. (Without using empirical formula) Given the following data: Size of the absorber plate ($L_1 \times L_2$) : 3 m \times 2m Spacing between plate and the first glass cover (L) : 3 cm Spacing between first and the second glass cover (L) : 3 cm Plate emissivity (ϵ_p) : 0.92 Glass cover emissivity (ϵ_c) : 0.88 Collector tilt (β) : 20°	12	CO2	3	2.4.1



	Mean Plate temperature (T_{pm}) : 75°C Ambient air temperature (T_a) : 32°C Wind speed (V_∞) : 3 m/s Back insulation thickness (δ_b) : 8 cm Side insulation thickness (δ_s) : 4 cm Thermal conductivity of insulation (k_i) : 0.05 W/m-K				
2(b)	Discuss the effect of following parameters on the performance of liquid flat plate collector. (a) Selective surface (b) Number of covers (c) Spacing between absorber plate and covers (d) Collector tilt	08	CO1	1	1.4.1
3(a)	A photovoltaic cell has an open circuit voltage of 0.6 V and a short circuit current of 300 A/m ² at a cell temperature of 40°C. Calculate the voltage and current density that maximizes the power of the cell. What would be the corresponding maximum power output per unit cell area? Given that charge of an electron, $e = 1.602 \times 10^{-19}$ J/V and Boltzmann constant, $k = 1.381 \times 10^{-23}$ J/K	10	CO2	3	2.4.1
3(b)	Classify the water turbines. Write in detail Kaplan propeller turbine and Francis propeller turbine with neat sketch of each.	10	CO2	3	2.4.1
4(a)	A residential house has a power requirement of 800 W for 5 hours every night. It is proposed to meet the requirement by using a PV array, a battery storage system and an inverter. The whole system is over designed so that it can meet one extra night's requirement even if there has been no sunshine during the day. Calculate the number of PV modules and batteries required. Given: (i) Solar radiation is available for an average of six hours daily and the average hourly global radiation flux incident on the array is 750 W/m ² , (ii) Battery rating = 12V; 120 Ah, Depth of discharge = 0.7, Charging and discharging efficiency = 0.9 (iii) Inverter efficiency at full load = 0.85 (iv) Use PV module area used is 119.1 cm x 53.3 cm, use conversion efficiency of 10 per cent for given global radiation	10	CO3	2	1.4.1



Bharatiya Vidya Bhavan's
SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)
Munshi Nagar, Andheri (W) Mumbai – 400058
End Semester Examination May 2022



4(b)	What is geothermal energy? Explain dry steam power plant and flash steam power plant with neat sketch.	10	CO4	1	1.4.1																																																								
5(a)	Calculate the actual energy content available for wind machine for which the cut in speed is 10 kmph, the design speed is 28 kmph and the cut-out speed is 70 kmph for following location. Location : Kandla Port Month : November Take density for air, $\rho = 1.20 \text{ kg/m}^3$. <table><tr><td>Interval</td><td>Nov</td><td>Interval</td><td>Nov</td><td>Interval</td><td>Nov</td><td>Interval</td><td>Nov</td></tr><tr><td>00</td><td>4.6</td><td>10-12</td><td>8.1</td><td>22-24</td><td>6.1</td><td>34-36</td><td>0.3</td></tr><tr><td>00-02</td><td>4.4</td><td>12-14</td><td>9.7</td><td>24-26</td><td>4.2</td><td></td><td></td></tr><tr><td>02-04</td><td>4.8</td><td>14-16</td><td>10.2</td><td>26-28</td><td>2.5</td><td></td><td></td></tr><tr><td>04-06</td><td>4.5</td><td>16-18</td><td>9.0</td><td>28-30</td><td>1.3</td><td></td><td></td></tr><tr><td>06-08</td><td>6.5</td><td>18-20</td><td>9.3</td><td>30-32</td><td>0.6</td><td></td><td></td></tr><tr><td>08-10</td><td>7.6</td><td>20-22</td><td>6.0</td><td>32-34</td><td>0.3</td><td></td><td></td></tr></table>	Interval	Nov	Interval	Nov	Interval	Nov	Interval	Nov	00	4.6	10-12	8.1	22-24	6.1	34-36	0.3	00-02	4.4	12-14	9.7	24-26	4.2			02-04	4.8	14-16	10.2	26-28	2.5			04-06	4.5	16-18	9.0	28-30	1.3			06-08	6.5	18-20	9.3	30-32	0.6			08-10	7.6	20-22	6.0	32-34	0.3			10	CO2	3	2.4.2
Interval	Nov	Interval	Nov	Interval	Nov	Interval	Nov																																																						
00	4.6	10-12	8.1	22-24	6.1	34-36	0.3																																																						
00-02	4.4	12-14	9.7	24-26	4.2																																																								
02-04	4.8	14-16	10.2	26-28	2.5																																																								
04-06	4.5	16-18	9.0	28-30	1.3																																																								
06-08	6.5	18-20	9.3	30-32	0.6																																																								
08-10	7.6	20-22	6.0	32-34	0.3																																																								
5(b)	Explain the method of Bio-ethanol and Bio-diesel production in detail.	10	CO4	1	1.4.1																																																								
6(a)	Calculate the efficiency of closed cycle OTEC system using ammonia as the working fluid and installed at a location where the warm and cold sea water streams are at temperature of 35°C and 5°C respectively. Make an allowance of about 5°C for the temperature difference required in the evaporator and condenser for transferring heat, and assume that the ammonia is evaporating at 30°C and condensing at 10°C. Take the isentropic efficiencies of the turbine and pump to be 90 and 80 per cent respectively.	10	CO3	3	2.4.1																																																								
6(b)	Draw neat schematic diagram of downdraft gasifier and explain the biomass gasification process in detail.	10	CO4	1	1.4.1																																																								
7(a)	Calculate the main dimension of the rotor of a multi blade wind machine operating at a design wind speed of 25 kmph. The machine operates a water pump having a capacity of 5.1 m ³ /h and a lift of 9 m.	10	CO4	2	1.4.1																																																								
7(b)	Explain with neat sketch the production of biogas by KVIC model plant.	10	CO1	1	1.4.1																																																								



Bharatiya Vidya Bhavan's SARDAR PATEL COLLEGE OF ENGINEERING

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

End Semester Examination May 2022



1. Relationship between Nusselt and Rayleigh numbers.

$$Nu_L = 1 ; Ra_L \cos \beta < 1708$$

$$Nu_L = 1 + 1.446 \left(1 - \frac{1708}{Ra_L \cos \beta} \right) ; 1708 < Ra_L \cos \beta < 5900$$

$$Nu_L = 0.229 (Ra_L \cos \beta)^{0.252} ; 5900 < Ra_L \cos \beta < 9.23 \times 10^4$$

$$Nu_L = 0.157 (Ra_L \cos \beta)^{0.283} ; 9.23 \times 10^4 < Ra_L \cos \beta < 10^6$$

2. Properties of dry air.

Table A.4.2 Properties of dry air at atmospheric pressure

T °C	ρ kg/m ³	C_p kJ/kg·K	$\mu \times 10^6$ N·s/m ²	k W/m·K	Pr	$\nu \times 10^6$ m ² /s
0	1.293	1.005	17.2	0.0244	0.707	13.28
10	1.247	1.005	17.7	0.0251	0.705	14.16
20	1.205	1.005	18.1	0.0259	0.703	15.06
30	1.165	1.005	18.6	0.0267	0.701	16.00
40	1.128	1.005	19.1	0.0276	0.699	16.96
50	1.093	1.005	19.6	0.0283	0.698	17.95
60	1.060	1.005	20.1	0.0290	0.696	18.97
70	1.029	1.009	20.6	0.0297	0.694	20.02
80	1.000	1.009	21.1	0.0305	0.692	21.09
90	0.972	1.009	21.5	0.0313	0.690	22.10
100	0.946	1.009	21.9	0.0321	0.688	23.13
120	0.898	1.009	22.9	0.0334	0.686	25.45
140	0.854	1.013	23.7	0.0349	0.684	27.80
160	0.815	1.017	24.5	0.0364	0.682	30.09
180	0.779	1.022	25.3	0.0378	0.681	32.49
200	0.746	1.026	26.0	0.0393	0.680	34.85
250	0.674	1.038	27.4	0.0427	0.677	40.61
300	0.615	1.047	29.7	0.0461	0.674	48.33
350	0.566	1.059	31.4	0.0491	0.676	55.46
400	0.524	1.068	33.0	0.0521	0.678	63.09
500	0.456	1.093	36.2	0.0575	0.687	79.38
600	0.404	1.114	39.1	0.0622	0.699	96.89
700	0.362	1.135	41.8	0.0671	0.706	115.4
800	0.329	1.156	44.3	0.0718	0.713	134.8
900	0.301	1.172	46.7	0.0763	0.717	155.1
1000	0.277	1.185	49.0	0.0807	0.719	177.1



Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

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



END SEMESTER Examination - MAY 2022 Examinations

Program: BTECH (MECH. ENGG.)

Course Code: SE-BTM891

Course Name: BIG DATA ANALYTICS

Duration: 3hr

Maximum Points: 100

Semester: VIII

23/5/22

Final yr. 1. Term (Mech) Sem VIII

- Solve any five questions out of seven
- Figures to the right indicate full marks
- Assume Suitable data wherever necessary

Q.No.	Questions	Points	CO	BL	PI
Q.1 (a)	Explain evolution of BIG DATA ANALYTICS along with a figures.	[10]	1,2	2	3.2.1
(b)	Explain Cloud Computing along with its features, advantages & applications	[10]	2,3	2	3.2.1
Q.2 (a)	Explain HADOOP Ecosystem & explain the functions of technology components in HADOOP in brief.	[10]	2,3	3	5.1.2
(b)	Explain the working of MAPREDUCE with example? Explain parallel processing in MAPREDUCE?	[10]	2,4	2	3.2.1
Q.3 (a)	What is YARN? Explain its & advantages? Explain components of YARN with neat figures?	[10]	1,3	2	3.2.1
(b)	Explain PIG architecture with neat sketches?	[10]	2,3	2	3.2.1
Q.4 (a)	Explain many to one and one to many correspondence in MONGODB NOSQL database with the help of an example	[10]	2,3	2	3.2.1
(b)	Explain the various Centrality Algorithms (Graph Analytics) in NEO4J with an example	[10]	3,4	2	3.2.1
Q.5 (a)	Explain the concept & significance of Polyglot Persistence with the help of an example? Draw neat figures for the same	[10]	3,4	3	5.1.2
(b)	Explain the concept of CAP theorem with neat figures? Also explain?	[10]	3,4	3	5.1.2



Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

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



END SEMESTER Examination - MAY 2022 Examinations

Q.6 (a)	What are the problems with RDBMS in storing image data? How they are overcome using NOSQL databases?	[10]	2,4	3	5.1.2
(b)	Compare PIG, HIVE & HBASE? Also explain Graph NOSQL database with neat figure?	[10]	2,4	2	3.2.1
Q.7 (a)	Explain the HBASE architecture components?	[10]	2	3	5.1.2
(b)	Explain YARN Commands with their Syntax & use? Also explain HDFS architecture?	[10]	2,3	2	3.2.1
***** All the Best *****					



Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

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



23/5/22

END SEMESTER EXAMINATION MAY 2022

Program: Final year B. Tech. (Mech) Sem VII

Course Code: OE-BTM712

Course Name: Introduction to Research Methodology

Duration: 03 Hrs.

Maximum Points: 100

Semester: VIII

Notes:

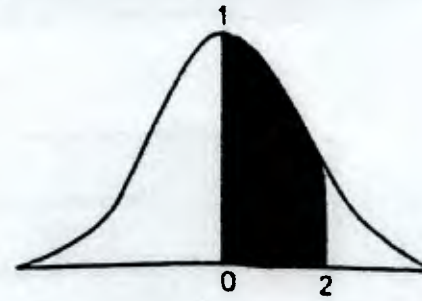
1. Attempt any **FIVE** questions
2. Each question carries equal marks
3. Assume suitable data wherever necessary and justify the same

Q.No.	Questions	Points	CO	BL	PI
1	a) What are the objectives of research? b) Differentiate between qualitative and quantitative approaches. c) State and explain characteristics of research. d) How would you define a technical research? What are the major components of good research study?	20	1	2	4.4 .2
2	a) The training manager at ABC Corporation has asked you to identify the kind of training programmes that should be offered to the young recruits who have joined as graduate trainees and are to be imparted five additional general technical programmes along with their specific job training modules. The trainees are a mixed bunch of engineering and management graduates. <ul style="list-style-type: none"> • Formulate your research problem. • State your research objectives b) Classify research design giving appropriate examples.	10 10	1	2	4.4 .2
3	a) Explain the criteria used for systematic review. b) Describe steps in the Literature Review Process.	10 10	1		3.5 .3
4	a) Distinguish between secondary and primary methods of data collection methods. Is it possible to use secondary data methods as substitutes of primary methods? Justify your answer with suitable illustrations. b) You have been assign a task of carrying out an FGD for a new radio station FM 42.0 Radio Chilz. The channel is meant for generation Y (those born after 1990). You need to get information from the assigned group on: <ul style="list-style-type: none"> • What should be the punch line? • What kind of programs should you air? • What would be the requirement if you hire RJ's (Radio Jockey)? 	10 10	3	3	2.5 .1

	Write down the discussion guide for the following study. What elements should the moderator be careful about? How will he screen the respondents?																																																		
5	<p>a) Use least square regression to fit a straight line to</p> <table><tr><td>X</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr><tr><td>Y</td><td>1</td><td>1.5</td><td>2</td><td>3</td><td>4</td><td>5</td><td>8</td><td>10</td></tr></table> <p>Along with the slope and intercept, compute the standard error of the estimate and the correlation coefficient.</p> <p>b) Given the data:</p> <table><tr><td>28.65</td><td>26.55</td><td>26.65</td><td>27.65</td><td>27.35</td><td>28.35</td><td>26.85</td></tr><tr><td>28.65</td><td>29.65</td><td>27.85</td><td>27.05</td><td>28.25</td><td>28.85</td><td>26.75</td></tr><tr><td>27.65</td><td>28.45</td><td>28.65</td><td>28.45</td><td>31.65</td><td>26.35</td><td>27.75</td></tr><tr><td>29.25</td><td>27.65</td><td>28.65</td><td>27.65</td><td>28.55</td><td>27.65</td><td>27.25</td></tr></table> <p>Determine (a) mean, (b) standard deviation (c) variance (d) coefficient of variation (d) the 90% confidence interval of the mean.</p>	X	1	2	3	4	5	6	7	8	Y	1	1.5	2	3	4	5	8	10	28.65	26.55	26.65	27.65	27.35	28.35	26.85	28.65	29.65	27.85	27.05	28.25	28.85	26.75	27.65	28.45	28.65	28.45	31.65	26.35	27.75	29.25	27.65	28.65	27.65	28.55	27.65	27.25	10			
X	1	2	3	4	5	6	7	8																																											
Y	1	1.5	2	3	4	5	8	10																																											
28.65	26.55	26.65	27.65	27.35	28.35	26.85																																													
28.65	29.65	27.85	27.05	28.25	28.85	26.75																																													
27.65	28.45	28.65	28.45	31.65	26.35	27.75																																													
29.25	27.65	28.65	27.65	28.55	27.65	27.25																																													
6	<p>a) In certain food experiment to compare two types of baby foods A and B, the following results of increase in weight (lbs) we observed in 8 children as follows.</p> <table><tr><td>Food A (x)</td><td>49</td><td>53</td><td>51</td><td>52</td><td>47</td><td>50</td><td>52</td><td>53</td></tr><tr><td>Food B (y)</td><td>52</td><td>55</td><td>52</td><td>53</td><td>50</td><td>54</td><td>54</td><td>53</td></tr></table> <p>Examine the significance of increase in weight of children due to food B.</p> <p>b) A group of 5 patients treated with medicine. A is of weight 42,39,38,60 &41 kgs. Second group of 7 patients from the same hospital treated with medicine B is of weight 38, 42, 56, 64, 68, 69, & 62 kgs. Find whether there is any difference between medicines?</p>	Food A (x)	49	53	51	52	47	50	52	53	Food B (y)	52	55	52	53	50	54	54	53	10	10																														
Food A (x)	49	53	51	52	47	50	52	53																																											
Food B (y)	52	55	52	53	50	54	54	53																																											
7	<p>a) Describe the layout of technical report writing.</p> <p>b) State precautions to be taken while preparing a research report.</p>	10	10																																																

Table 1: Area Under Normal Curve

An entry in the table is the proportion under the entire curve which is between $z = 0$ and a positive value of z . Areas for negative values for z are obtained by symmetry.



Areas of a standard normal distribution

z	.0	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
.7	.2580	.2611	.2642	.2673	.2703	.2734	.2764	.2794	.2823	.2852
.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990

Table 2: Critical Values of Student's *t*-Distribution

d.f.	Level of significance for two-tailed test					d.f.
	0.20	0.10	0.05	0.02	0.01	
	Level of significance for one-tailed test					
	0.10	0.05	0.025	0.01	0.005	
1	3.078	6.314	12.706	31.821	63.657	1
2	1.886	2.920	4.303	6.965	9.925	2
3	1.638	2.353	3.182	4.541	5.841	3
4	1.533	2.132	2.776	3.747	4.604	4
5	1.476	2.015	2.571	3.365	4.032	5
6	1.440	1.943	2.447	3.143	3.707	6
7	1.415	1.895	2.365	2.998	3.499	7
8	1.397	1.860	2.306	2.896	3.355	8
9	1.383	1.833	2.262	2.821	3.250	9
10	1.372	1.812	2.228	2.764	3.169	10
11	1.363	1.796	2.201	2.718	3.106	11
12	1.356	1.782	2.179	2.681	3.055	12
13	1.350	1.771	2.160	2.650	3.012	13
14	1.345	1.761	2.145	2.624	2.977	14
15	1.341	1.753	2.731	2.602	2.947	15
16	1.337	1.746	2.120	2.583	2.921	16
17	1.333	1.740	2.110	2.567	2.898	17
18	1.330	1.734	2.101	2.552	2.878	18
19	1.328	1.729	2.093	2.539	2.861	19
20	1.325	1.725	2.086	2.528	2.845	20
21	1.323	1.721	2.080	2.518	2.831	21
22	1.321	1.717	2.074	2.508	2.819	22
23	1.319	1.714	2.069	2.500	2.807	23
24	1.318	1.711	2.064	2.492	2.797	24
25	1.316	1.708	2.060	2.485	2.787	25
26	1.315	1.706	2.056	2.479	2.779	26
27	1.314	1.703	2.052	2.473	2.771	27
28	1.313	1.701	2.048	2.467	2.763	28
29	1.311	1.699	2.045	2.462	2.756	29
Infinity	1.282	1.645	1.960	2.326	2.576	Infinity