G. S. Mandal's

Maharashtra Institute of Technology, Aurangabad

(An Autonomous Institute)

MAKE-UP EXAMINATION

First Year M.Tech(ME) -April/May 2022

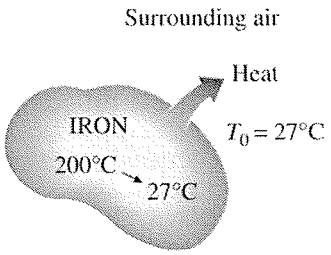
Course Code : MTM104 **Course Name : Advanced Thermodynamics**

Duration : 2 Hrs **Max. Marks : 50** **Date : 0705/2022**

Instructions :
i) All questions are compulsory
ii) Assume suitable data wherever necessary and clearly state it
iii)Figures to the right indicate full marks
iv)Use of Simple Calculator is allowed

Q. 1	**Solve/Answer any five (Marks:10)**			
	Questions	Marks	CO	BL
a)	Enlist factors on which the entropy of a real gas depends.	2	1	2
b)	Consider a rigid tank that contains a mixture of two ideal gases. The gas mixture is heated and the pressure and the temperature in the tank rise. Will the partial pressure of each component change? How about the pressure fraction of each component?	2	1	2
c)	Differentiate between 'reversible and irreversible processes.	2	1	2
d)	Explain applications of the 'Third law of Thermodynamics?'	2	1	2
e)	State first law of thermodynamics for an open system.	2	1	2
f)	State 'Amagat's Law.	2	1	2
Q. 2	Explain the importance of 'laws of corresponding states' and 'Compressibility chart'.	8	2	5
Q. 3	Using the ideal-gas equation of state, verify (a) the cyclic relation and (b) the reciprocity relation at constant v.	8	3	3
Q. 4	Analyze change in states of water using a phase diagram of water also comment on useful work of the process.	8	6	4
Q. 5	Two vessels, A and B, both containing nitrogen, are connected by a valve that is opened to allow the contents to mix and achieve an equilibrium temperature of 27 °C. Before mixing the following information is known about the gases in the two vessels.	8	5	4

Vessel A	Vessel B
Pressure=1.5 MPa	Pressure=0.6 MPa

	<table><tr><td>Temperature=50 °C</td><td>Temperature=20 °C</td></tr><tr><td>Content=0.5 kgmol</td><td>Content=2.5 kgmol</td></tr></table> Calculate final equilibrium pressure and the amount of heat transferred to the surroundings. If the vessel had been perfectly insulated, calculate the final temperature and pressure which would have been reached. Take γ=1.4 **(OR)**			
Q. 5	Prove that the molar analysis is identical with the volumetric analysis, and both are equal to the ratio of the partial pressure to the total pressure.	8	5	4
Q. 6	Explain "Decrease of exergy principle and Exergy destruction'. **OR**	8	4	5
Q. 6	A 500-kg iron block shown in the figure is initially at 200°C and is allowed to cool to 27°C by transferring heat to the surrounding air at 27°C. Determine the reversible work and the irreversibility of this process.  Take Specific heat for iron =0.45 kJ/kg. K	8	4	5