University Institute of Engineering & Technology

(Recognised Under Section 2(f) and 12B of UGC)

Kurukshetra University, Kurukshetra

TIME – 3 Hrs 15Min

THEORY EXAMINATION – FEB 2021	
B.TECH - ECE	**SEMESTER - III**

M.M. - 56

PAPER - MEC-205	**SUBJECT - Thermodynamics**

INSTRUCTIONS TO BE FOLLOWED

- **Allotted time for examination is 3 hours 15 minutes that includes time for downloading the question paper, writing answers, scanning of answer sheets and E-mailing the PDF files to the designated Email ID.**
- **For all B Tech. Mechanical Engineering Students, the Email ID is:- btechmechuiet@kuk.ac.in**
- **The candidates will be required to attempt 75% of the question paper (maximum) by choosing to their any best questions accumulating 56 marks.**
- **The PDF files should be saved as Roll No. and Subject Code. Proper attention should be given while sending the email and in the subject line, the Roll Number and Subject Code should be mentioned.**
- **Maximum Page Limit should be 20 (Twenty) for attempting the question paper on A4 sheets which could be downloaded and printed from the sample sheets given in the Kurukshetra University Examination guidelines.**
- **Over-attemptation should be avoided.**
- **Handwriting should be neat and clean and diagrams should be clear and contrasted.**
- **The candidate should not write their Mobile No. otherwise Unfair Means Case will be made.**
- **While attempting the paper, the candidate will use blue/black pen only.**
- **Before attempting the paper, the candidate will ensure that he/she has downloaded the correct question paper. No complaint for attempting wrong question paper by the candidate will be entertained.**
- **Candidate must ensure that he/she has put his/her signature on each page of the answer sheet used by him/her. Answer sheet without the signature of the candidate will not be evaluated.**

PART-A

Q. No. – 1 Answer the following questions carrying one mark each. 15x1=15

(i)	What is concept of thermodynamic work?
(ii)	Discuss the Zeroth law of thermodynamics.
(iii)	Discuss the perpetual motion machine of first kind.
(iv)	Discuss one corollary of Carnot theorem.
(v)	Define heat sink.
(vi)	What is thermodynamic temperature scale?
(vii)	Define effectiveness.
(viii)	What is high and low grade of energy?
(ix)	Differentiate between the heat pump and refrigerator.
(x)	Define availability.
(xi)	How boiling differs from evaporation?
(xii)	Define thermal efficiency.
(xiii)	Discus the throttling process to measure the dryness fraction.
(xiv)	Define entropy.
(xv)	Discuss internal enrgy.

PART-B

2	Differentiate between the macroscopic and microscopic approach of thermodynamics.	**5**
3	Explain Carnot theorem and its corollaries.	**5**
4	Describe the Clausius inequality in detail.	**5**
5	Explain the process of steam generation at constant pressure.	**5**

PART-C

6	1. Derive the expression for the first law of thermodynamics for a closed system. 2. Explain state, path, process and cycle.	**5** **5**
7	Air (Cp=1.005kJ/kgK) is to be heated by hot exhaust gases in a cross flow heat exchanger before it enters the furnace. Air enters the heat exchanger at 95kPa and 20ºC at a rate of 1.6m3/s. The combustion gases (Cp=1.10kJ/kgK) enter at 1800C at a rate of 2.2 kg/s and leave at 95ºC. Determine the rate of heat transfer to the air, the outlet temperature of the air.	**10**
8	An elastic balloon behaves such that pressure is proportional to diameter and the balloon contains 0.5 kg air at 200 kPa, 30ºC. The balloon is momentarily connected to an air line at 400 kPa, 100ºC. Air is let in until the volume doubles, during which process there is a heat transfer of 50 kJ out of the balloon. Find the final temperature and the mass of air that enters the balloon.	**10**

9	2 kg of water at 40°C is mixed with 3 kg of water at 80°C in a steady flow process. Determine the temperature of resulting mixture and entropy change of the mixture process. What would be the unavailable energy with respect to the receiver at 45°C	**10**
10	A mass of 0.25 kg of air in a closed system expands from 2 bar and 60ºC to 1 bar and 40ºC, while receiving 1.05 kJ of heat from a reservoir at 100ºC. The surroundings atmosphere is at 0.95 bar and 27ºC. Determine the maximum work. How much of this work would be done on the atmosphere?	**10**
11	Derive the first and second TDS equations.	**10**
12	Steam at 15 bar and 300ºC expands isentropically in a steam turbine till the temperature falls to 80ºC. Find the condition of steam at the end of expansion process and the work done per kg of air. If the steam flow rate is 10 kg/s, what power will be produced by the turbine?	**10**
13	Derive the expression for the air standard efficiency of the Otto, Diesel and dual cycles	**10**