

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE Winter Examination – 2022 Course: B. Tech. Branch : Mechanical Engineering Semester : V Subject Code & Name: Applied Thermodynamics (BTMC506) Max Marks: 60 Date: Duration: 3 Hr.			
Instructions to the Students: 1. All the questions are compulsory. 2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in () in front of the question. 3. Use of non-programmable scientific calculators is allowed. 4. Use of steam table and Mollier diagram is allowed 5. Assume suitable data wherever necessary and mention it clearly.			
		(Level/CO)	Marks
Q.1	Solve Any Two of the following.		12
A)	How flue gas analysis is done by using Orsat apparatus, Explain by using a neat sketch.	(Understand/ CO1)	6
B)	% composition of liquid fuel by mass is C = 84.8 % , H ₂ = 15.2 % . Calculate i) minimum air required ii) composition of product of combustion if 15 % excess air is supplied.	(Apply /CO1)	6
C)	% volumetric analysis of a sample of flue gases of a coal fired boiler gave CO ₂ = 10.4 % , CO = 0.2 % , O ₂ = 7.8% and N ₂ = 81.6%. Gravimetric analysis of coal was C = 78 % , H ₂ = 6 % , O ₂ = 3 % and incombustible = 13 % . Estimate i) Minimum amount of air required ii) Air fuel ratio	(Apply /CO1)	6
Q.2	Solve Any Two of the following.		12
A)	Distinguish between induced draught and forced draught	(Understand/ CO3)	6
B)	A Lancashire boiler generates 2400 kg of dry saturated steam per hour at a pressure of 11 bar. The grate area is 3 m ² and 100 kg of coal is burnt per m ² of grate area per hour. Calorific value of coal is 32000 kJ/kg and the temperature of feed water is 25 ⁰ C . Determine i) factor of evaporation ii) equivalent evaporation iii) boiler efficiency.	(Apply /CO3)	6
C)	A boiler is equipped with a chimney of 30 meter height. The flue gases which pass through the chimney are at a temperature of 288 ⁰ C, whereas the atmospheric temperature is 18 ⁰ C. If the air flow through the chamber is 18 kg / kg of fuel, find i) theoretical draught in mm of water ii) velocity of flue gases passing through chimney , if 50 % draught is lost in friction.	(Apply /CO3)	6

Q. 3	Solve Any Two of the following.		12
A)	Represent the ideal Reheat cycle on the P-V & T-S diagram and derive the equation for its thermal efficiency.	(Understand/ CO2)	6
B)	A steam power plant is supplied with dry saturated steam at a pressure of 12 bar and exhausts into a condenser at 0.1 bar. Calculate i) turbine work per kg of steam ii) pump work per kg of steam iii) Rankine efficiency.	(Apply /CO2)	6
C)	Dry saturated steam at a pressure of 10 bar enters in a nozzle and with initial velocity of 90 m/s. The outlet pressure is 6 bar and outlet velocity is 435 m/s. The heat loss from the nozzle is 9 kJ/kg of steam flow. calculate the dryness fraction of steam and area at exit if inlet area is 1256 mm ² .	(Apply /CO4)	6
Q.4	Solve Any Two of the following.		12
A)	What are the sources of air leakage in steam condensers ? What is the effect of air leakage on condenser performance and how to eliminate air leakage in condensers ?	(Understand/ CO4)	6
B)	In a surface condenser, the vacuum maintained is 700 mm of Hg. The barometer reads 754 mm of Hg, if the temperature of condensate is 18 °C, determine i) mass of air per kg of steam ii) vacuum efficiency.	(Apply /CO4)	6
C)	Write short note on compounding of steam turbines	(Understand/ CO3)	6
Q. 5	Solve Any two of the following.		12
A)	Derive expression for work done per cycle for the reciprocating air compressor without clearance.	(Understand/ CO5)	6
B)	A single stage , single acting reciprocal compressor has a bore of 200 mm and stroke of 300 mm. It receives air at 1 bar and 20 °C, delivers it at 5.5 bar. If the compression follows law $PV^{1.3}=C$ and clearance is 5 % of stroke , determine , i) mean effective pressure ii) power required to drive the compressor if it runs at 500 rpm.	(Apply /CO5)	6
C)	Differentiate between rotary compressor and reciprocating compressor	(Understand/ CO5)	6
	*** End ***		