Paper id: 252798

Roll No: | | | | | | | | | | | | | |

BTECH
(SEM IV) THEORY EXAMINATION 2024-25
APPLIED THERMODYNAMICS

TIME: 3 HRS **M.MARKS: 100**

Note: Attempt all Sections. Steam table allowed. In case of any missing data;choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

Q No.	Question	CO	Level
a.	Define stoichiometric air-fuel ratio and its importance in combustion.	1	K2
b.	What is adiabatic flame temperature?	1	K2
c.	Draw the P-v and T-s diagrams for the Diesel cycle.	1	K2
d.	Define equivalent evaporation in boilers.	2	K2
e.	What is a binary vapour cycle? State its significance.	3	K2
f.	Explain the phenomenon of choked flow in nozzles.	3	K2
g.	Define reheat factor in a steam turbine.	3	K2
h.	What are the assumptions in Brayton cycle?	4	K2
i.	What is the function of an intercooler in a multi-stage reciprocating compressor?	4	K2
j.	Distinguish between turbojet and turboprop propulsion.	4	K2

SECTION B

2. Attempt any *three* of the following: **10 x 3 = 30**

a.	Derive the expression for air requirement per kg of fuel for complete combustion of C_3H_8.	1	K3
b.	With a neat T-s diagram, explain the working of a regenerative Rankine cycle.	2	K3
c.	What is the function of boiler mountings? Can a boilerwork without mountings?	2	K2
d.	Discuss the effect of supersaturation in steam nozzle performance.	3	K3
e.	Air enters the compressor of a gas turbine plant operating on Braytoncycle at 101.325 kPa, 27°C. The pressure ratio in the cycle is 6. Calculate the maximum temperaturein the cycle and the cycle efficiency. Assume $W_T = 2.5\ W_C$, where WT and WC are theturbine and the compressor work respectively. Take $\gamma = 1.4$.	4	K3

SECTION C

3. Attempt any *one* part of the following: **10 x 1 = 10**

a.	A fuel with a composition C_8H_{18} is burned with 20% excess air. Calculate the air-fuel ratio and dry product analysis by volume.	1	K4
b.	Write short notes on: (i) Enthalpy of formation, (ii) excess air(iii) Adiabatic flame temperature.	1	K2

4. Attempt any *one* part of the following: **10 x 1 = 10**

a.	In a Rankine cycle, the steam at inlet toturbine is saturated at a pressure of 35 bar and the exhaustpressure is 0.2 bar. Assume flow rate of 9.5 kg/s. Determine :(i) The pump work,(ii) The turbine work,(iii) The Rankine efficiency,(iv) The condenser heat flow,(v) The dryness at the end of expansion.	2	K4
b.	Explain with a neat diagram the working of a Binaryvapour cycle.	2	K2

5. Attempt any *one* part of the following: **10 x 1 = 10**

a.	The following data were taken during thetest on a boiler for a period of one hour : Steam generated = 5000 kg ; coal burnt = 700 kg,calorific valueof coal =	2	K4

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	31402 kJ/kg, quality of steam = 0.92. If the boiler pressure is 1.2 MPa and the feed watertemperature is 45°C, find the boiler equivalent evaporationand the efficiency.		
b.	Classify and describe surface condensers. What are the effects of air leakage and how is it measured?	2	K3

6. Attempt any *one* part of the following: 10 x 1 = 10

a.	Steam having pressure of 10.5 bar and0.95 dryness is expanded through a convergent-divergentnozzle and the pressure of steam leaving the nozzle is0.85 bar. Find the velocity at the throat for maximumdischarge conditions. Index of expansion may be assumedas 1.135. Calculate mass rate of flow of steam through thenozzle.	3	K4
b.	What do you mean by the compounding of steam turbines?Discuss various methods of compounding steam turbines.	3	K3

7. Attempt any *one* part of the following: 10 x 1 = 10

a.	Explain the working of a turbojet engine and differentiate it from a turboprop engine with sketches.	4	K2
b.	Discuss methods for Improvement of Thermal Efficiencyof Open Cycle Gas Turbine Plant.	4	K4