UNIT-II STEAM NOZZLE

S.No.		Questions	BT	CO	PO
Part – A (Short Answer Questions)					
1		Explain super saturated flow of steam in steam nozzles.	L2	CO2	PO2
2		Derive an expression for maximum mass flow through a convergent divergent nozzle when steam is expanded isentropic ally.	L2	CO2	PO2
3		What is the effect of friction on nozzle?.	L2	CO2	PO2
4		Draw different nozzle cross sections and explain them.	L1	CO2	PO2
5		Define Metastable state and critical velocity.	L2	CO2	PO2
6		Discuss the effects of friction on the performance of nozzles	L3	CO2	PO2
7		What do you understand by nozzle? Discuss different types of nozzles.	L1	CO2	PO2
8		What is the effect of friction on flow through steam efficiency	L2	CO2	PO2
9		What are the parameters affect the nozzle efficiency?	L2	CO2	PO2
10		Explain the phenomenon of supersaturated flow ?	L1	CO2	PO2
Part – B (Long Answer Questions)					
11	a)	Derive the equation for critical pressure ratio of nozzle for different conditions.	L2	CO2	PO2
	b)	In a convergent-divergent nozzle, the steam enters at 15 bar and 300 ^{0}C and leaves at 2 bar. The inlet velocity to the nozzle is 150 m/s. Find the required throat and exit areas for a mass flow rate of 1 kg/s. Assume nozzle efficiency to be 90% and C_{ps} = 2.4 kJ/kg K.	L2	CO2	PO2
12		Derive the equation for critical pressure ratio in nozzles.	L2	CO2	PO2
13		Air is expanded reversibly and adiabatically in a nozzle from 13 bars and 150^{0}C to a pressure of 6 bar. The inlet velocity of the nozzle is very small and the process occurs under steady flow conditions. Calculate the exit velocity of the nozzle. b) Describe the 'over expansion' and 'under expansion' in nozzles.	L1	CO2	PO2

14		Calculate the throat and exit diameters of a convergent- divergent nozzle, which will discharge 820 kg of steam per hour at a pressure of 8 bar superheated to 220^{0}C into a chamber having a pressure of 1.5 bar. The friction loss in the divergent portion of the nozzle may be taken as 0.15 of the isentropic enthalpy drop.	L1	CO2	PO2
15		A convergent-divergent nozzle is required to discharge 2 kg of steam per second. The nozzle is supplied with steam of 10 bar and 200 ^{0}C and discharge takes place against a back pressure of 0.34 bar. Estimate the throat and exit areas. Assume isentropic flow and take the index n = 1.3. If the nozzle efficiency is assumed to be 85%, determine the exit area.	L1	CO2	PO2
16		A single stage of simple impulse turbine produce 120 kW at blade speed of 150 m/s when steam mass flow rate is 3 kg/s. Steam enters moving blade at 350 m/s and leaves the stage axially. Considering velocity coefficient of 0.9 and smooth entry without shock into blades, determine the nozzle angle and blade angles. Solve using velocity diagram.	L1	CO2	PO2
17		An impulse turbine of 1MW has steam entering at 20 bar 3000C and steam consumption of 8 kg per kW hour. Steam leaves at 0.2 bar and 10% of total heat drop is lost in overcoming friction in deveining portion of nozzle. If throat diameter of each nozzle is 1 cm then determine (i) the number of nozzle required (ii) exit diameter of each nozzle. Solve using mollier diameter	L4	CO2	PO2