Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2022

Course: Heat Transfer **Semester : VI**
Program: Automotive Design Engineering **Time : 03 hrs.**
Course Code: MECH3015 **Max. Marks: 100**

Instructions:

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Explain the Analogy between heat and the electricity flow.	**4**	**CO1**
Q 2	Write short notes on Radiation shields.	**4**	**CO1**
Q 3	Define critical thickness of insulation and write down the critical radius of insulation for cylinder and sphere.	**4**	**CO1**
Q 4	Explain the process of condensation and which type of condensation process is preferred for maximum heat transfer?	**4**	**CO1**
Q 5	A large surface at 50 °C is exposed to air at 20 °C. If the heat transfer coefficient between the surface and the air is 15 W/(m^2-K), determine the heat transferred from 5 m^2 of the surface area in 2 hours.	**4**	**CO3**
	SECTION B **(4Qx10M= 40 Marks)**		
Q 6	Air at atmospheric pressure and at 40°C flows with a velocity of 5 m/s over a 2-m-long flat plate whose surface is kept at a uniform temperature of 120°C. Determine the rate of heat transfer between the plate and the air per meter width of the plate.	**10**	**CO3**
Q 7	Discuss with the help of diagram, the boiling curve and explain all the phases. Which boiling phase is recommended for boiling and why?	**10**	**CO4**
Q 8	A long solid cylinder [α = 0.05 m^2/h, k = 50 W/(m-K)] of 5 cm diameter is initially at 200°C. Suddenly it is immersed in water at a temperature of 20°C. Assuming the heat transfer coefficient to be 200 W/(m^2K), determine (a) the centre and the surface temperatures after 10 minutes have elapsed, and (b) the energy removed from the cylinder during this 10 minute period.	**10**	**CO3**
Q 9	Derive an expression for three dimensional heat conduction equation in the Cartesian coordinates.	**10**	**CO2**

SECTION-C (2Qx20M=40 Marks)			
Q 10	Derive an expression to determine the rate of heat transfer for a rectangular fin having infinite length.	**20**	**CO2**
Q 11	A motor body is 360 mm in diameter (outside) and 240 mm long. Its surface temperature should not exceed 55°C when dissipating 340W. Longitudinal fins of 15 mm thickness and 40 mm height are proposed. The convection coefficient is 40 $W/m^2°C$. determine the number of fins required. Atmospheric temperature is 30°C, thermal conductivity = 40 W/m°C. **OR** Two large plates of a thermal system; one at 1000 K with emissivity 0.8, and another at 300 K having emissivity 0.6. A radiation shield is placed between them. The shield has emissivity as, 0.1 on the side facing hot plate, 0.3 on the side facing cold plate. Determine the percentage reduction in radiation heat transfer as a result of radiation shield.	**20**	**CO4**