B.E. MECHANICAL ENGINEERING FOURTH YEAR FIRST SEMESTER EXAM 2024

Steam Turbine (Hons.)

Time: 3 hours **Full Marks 100**

Answer any five questions

All parts of the same question must be answered together. Assume any unfurnished data suitably
Use of Thermodynamic Tables and Charts permitted

Q:1 (a) What do you understand by Willan's line? 5
(b) Compare diagram efficiencies of simple impulse, two-row Curtis and 50% reaction stages. 10
(c) How is the number of stages in a turbine estimated? 5

Q:2 (a) Why is a two row Curtis stage most often use as the first stage in large steam turbines? 6

(b) The Steam velocity at inlet of a turbine having two row velocity compounded wheel is 650 m/s and the mean blade velocity is 120 m/s. The nozzle angle is 18^0 and the exit angle for first row of moving blades, the fixed blades and the second row of moving blades are 20^0, 25^0 and 40^0 respectively. Find the blade inlet angles for each row. Find also for each row of moving blades the driving force and the axial thrust on the wheel for a mass flow rate of 1 kg/s of steam flow. Find the diagram efficiency for the wheel and the diagram power. What is the maximum possible diagram efficiency for a given inlet velocity and nozzle angle. Take blade friction factor as 0.8 for all blades. 14

Q:3 (a) Explain with neat sketch working of a pressure compounded impulse turbine. 10
(b) State advantages of such turbine. 5
(c) What is carry over coefficient? What is the importance of considering such a parameter? 5

Q:4 (a) What are parallel exhausts? Why are these needed? How do you calculate number of parallel exhausts for a given steam flow rate? 15
(b) With neat sketch show a casing arrangement if the number of parallel exhausts are four considering Tandem compounding. 5

Q:5 (a) What do you mean by governing of steam turbines? 5
(b) With neat sketch explain different types of governing. 15

Q:6 (a) What do you understand by reheat factor? Why is reheat factor greater than unity? 10
(b) Prove that internal efficiency of turbine is greater than stage efficiency. 10

Q:7 Write *short notes* on the followings:
(a) Dummy piston, (b) Shrouding, (c) Critical speed, and (d) Turning gear. 20