Reg.No.

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**End Semester Examination – Nov/Dec -2019**

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| **Code :** | **14ME2015** | **Duration :** | **3hrs** |
| **Sub. Name :** | **THERMAL ENGINEERING – I** | **Max. Marks :** | **100** |

ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)

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| **Q.**  **No.** | **Sub Div.** | **Questions** | **Course Outcome** | **Marks** |
| 1. |  | In a boiler the following observations were made: pressure of steam =10 bar, steam condensed = 540 kg/h, fuel used = 65 kg/h, moister in fuel = 2 % by mass, mass of dry flue gases = 9 kg/kg of fuel, lower calorific value of fuel = 32000 KJ/Kg, temperature of the flue gases = 325oC, temperature of boiler house = 28oC, feed water temperature = 50oC, mean specific heat of flue gases = 1 KJ/kgK, dryness fraction of steam = 0.95. Draw up a heat balance sheet for the boiler. | CO1 | 20 |
| **(OR)** | | | | |
| 2. | a. | Steam of5400 kg is produced per hour at a pressure of 750 kN/m2 and 0.98 dryness fraction in a boiler when feed water at 41.50C. The amount of coal burnt per hour is 670 kg/hr and its calorific value 31000 kJ/kg. Determine the boiler efficiency and equivalent evaporation. | CO1 | 10 |
| b. | Describe with a neat sketch the construction and working of Cochran boiler. | CO1 | 10 |
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| 3. | a. | Derive an expression for maximum discharge through convergent divergent nozzle for steam. | CO2 | 14 |
| b. | Dry saturated steam at 5 bar with negligible velocity expands isentropically in a converget nozzle to 1 bar and dryness fraction 0.94. Determine the velocity of steam leaving the nozzle. | CO2 | 06 |
| **(OR)** | | | | |
| 4. | a. | Estimate the mass flow rate of steam in a nozzle with the following data : Inlet pressure = 10bar, Inlet temperature =200°C, back pressure =0.5bar, throat diameter =12mm. | CO2 | 10 |
| b. | Dry saturated steam at 10 bar is expanded isentropically in a nozzle to 0.1bar.Find the dryness fraction of the steam at exit. Also find the velocity of steam leaving the nozzle when i) initial velocity is negligible ii) initial velocity of the steam is 135m/s | CO2 | 10 |
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| 5. |  | The velocity of steam, leaving the nozzle of an implse turbine, is 1200m/s and the nozzle angle is 20°. The blade velocity is 375 m/s and the blade velocity coefficient is 0.75. Assuming no loss due to shock at inlet, calculation for a mass flow of 0.5 kg/s and symmetrical blading: (i) blade inlet angle; (ii) driving force on the wheel; (iii) axial thrust on the wheel; and (iv) power developed by the turbine. | CO3 | 20 |
|  |  | **(OR)** |  |  |
| 6. | a. | Distinguish between impulse and reaction turbine. | CO3 | 10 |
| b. | Explain the term ‘compounding of steam turbine’ and discuss the pressure-velocity compounding of turbine with neat sketch. | CO3 | 10 |
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| 7. |  | With neat sketches of T-s and p-v diagram for a single stage reciprocating air compressor without clearance, derive the expression for the workdone when compression is isothermal and isentropic. | CO4 | 20 |
| **(OR)** | | | | |
| 8. | a. | Define:  i) single acting compressor ii) Volumetric efficiency  iii) Displacement of the compressor iv) Free air delivery | CO4 | 10 |
| b. | Estimate the minimum work required to compress 1 kg of air from 1 bar 27°C to 16 bar in two stages, if the law of compression is pv1.25= constant and the intercooling is perfect.Take R = 287J/kgK. | CO4 | 10 |
|  | | **Compulsory:** |  |  |
| 9. |  | With the neat sketch, explain the working principle of vapour compression refrigeration system also draw the T-s and p-h diagram. | CO5 | 20 |