Reg. No. \_\_\_\_\_\_\_\_\_\_\_\_



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

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| **Code :** | **17ME2011** | **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. | a. | A steam generator evaporates 18000 kg/hr of steam at 12.5 bar and a quality of 0.97 from feed water at 1050C, when coal is fired at the rate of 2040 kg/hr. If the higher calorific value of coal is 27400 kJ/kg, find:  (i) The heat rate of biler in Kj/hr;  (ii) The equivalent evaporation;  (iii) The thermal efficiency. | CO1 | 15 |
| b. | Write short notes on boiler trial. | CO1 | 5 |
| **(OR)** | | | | |
| 2. | a. | In a boiler test 1250 kg of coal are consumed in 24 hours. The mass of water evaporated is 13000 kg and the mean effective pressure is 7 bar. The feed water temperature was 400C, heating value of coal is 30000 kJ/kg. The enthalpy of 1 kg of steam aat 7 bar is 2570.7 Kj. Determine:  Equivalent evaporation per kg of coal;  Efficiency of the boiler. | CO1 | 10 |
| b. | Enumerate the heat losses which occur in a boiler plant. | CO1 | 10 |
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| 3. |  | Derive an expression for maximum discharge of steam flow through steam nozzle. | CO2 | 20 |
| **(OR)** | | | | |
| 4. | a. | Dry saturated steam enters a steam nozzle at a pressure of 15 bar and is discharged at a pressure of 2 bar. If the dryness fraction of discharge steam is 0.96, what will be the final velocity of steam? Neglect initial velocity of steam.  If 10% of heat drop is lost in friction, find the percentage reduction in the final velocity. | CO2 | 15 |
| b. | Discuss the effects of friction in flow through nozzle. | CO2 | 5 |
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| 5. |  | In a De-Laval turbine steam issues from the nozzle with a velocity of 1200 m/s. The nozzle angle is 20°, the mean blade velocity is 400 m/s, and the inlet and outlet angles of blades are equal. The mass of steam flowing through the turbine per hour is 1000 kg. Take blade velocity coefficient as 0.8. Calculate;  (a) Blade angles,  (b) Relative velocity of steam entering the blades,   1. (c) Tangential force on the blades, 2. (d) Power developed and   (e) Blade Efficiency. | CO3 | 20 |
| **(OR)** | | | | |
| 6. | a. | 1. Explain the pressure compounded impulse steam turbine showing pressure and velocity variations along the axis of the turbine. | CO3 | 10 |
| b. | 1. Explain with neat diagram the working of Reheating cycle. Represent the various processes on T-s and h-s diagram. | CO4 | 10 |
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| 7. | a. | Derive an expression for the volumetric efficiency of a single stage single acting reciprocating air compressor. | CO5 | 10 |
| b. | A single acting two stage air compressor with complete intercooling compress air from 1 bar and 300C to 16 bar. Calculate the workdone per kg of air delivered and the heat transfered in the intercooler. The compression follows a polytropic process with the compression index 1.3. | CO5 | 10 |
| **(OR)** | | | | |
| 8. | a. | Explain the working of a two stage reciprocating air compressor with a neat sketch and p-v diagram. | CO5 | 10 |
| b. | An air compressor takes in air at 1 bar and 200C and compresses it according to pv1.2=C. It is then delivered to a receiver at a constant pressure of 10 bar. R=287 J/kgK. Determine:  (i) Temperature at the end of compression;  (ii) Work done and heat transfered during compression per kg of air. | CO5 | 10 |
|  | | **Compulsory**: |  |  |
| 9. | a. | Explain vapor compression refrigeration system with a neat diagram. Represent the various processes on T-s and p-h diagram. | CO6 | 15 |
| b. | Compare vapor compression with vapor absorption refrigeration system. | CO6 | 5 |