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

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**End Semester Examination – Nov/Dec – 2018**

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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. | a. | The following data refer to a boiler plant consisting of an economizer, a boiler and a superheater.  Mass of water evaporated per hour = 5940 kg, mass of coal burnt per hour = 675kg,L.C.V of coal = 31600 kJ/kg, pressure of steam at boiler stop valve = 14 bar, temperature of feed water entering the economizer = 32°C,temperature of feed water leaving the economizer = 115°C,dryness fraction of steam leaving the boiler and entering superheater =0.96,temperature of steam leaving the superheater = 260°C,specific heat of superheated steam = 2.33.   1. Determine:percentage of heat in coal utilized in economizer,boiler and superheater: 2. Overall efficiency of boiler plant. | CO1 | 12 |
| b. | The following observations were made in a boiler trial:  Coal used 250 kg of calorific value 29,800 kJ/kg, water evaporated 2000 kg, steam pressure 11.5 bar, dryness fraction of steam 0.95 and feed water temperature 34 ºC.  Calculate the equivalent evaporation from and at 100 ºC per kg of coal and the efficiency of the boiler. | CO1 | 8 |
| (OR) | | | | |
| 2 |  | Explain the construction and working of a Bobcock and Wilcox  boiler with a neat sketch. Write its important features. | CO1 | 20 |
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| 3. |  | Dry saturated steam at a pressure of 10 bar is expanded isentropically in a nozzle to 0.1 bar. Find the dryness fraction of the steam at exit. Also find the velocity of steam leaving the nozzle | CO2 | 20 |
| (OR) | | | | |
| 4. | a. | What is the effect of friction on the flow through a steam nozzle ? Explain with the help of h-s diagram. | CO2 | 10 |
| b. | Derive an expression for maximum discharge through convergent divergent nozzle for steam. | CO2 | 10 |
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| 5. | a. | Explain the velocity compounding of steam turbine with a neat sketch. | CO3 | 10 |
| b. | Distinguish between impulse and reaction turbine. | CO3 | 10 |
| (OR) | | | | |
| 6. | a. | Explain the pressure compounding of steam turbine with a neat sketch. | CO3 | 10 |
| b. | The velocity of steam leaving the nozzles of an impulse turbine is 1200 m/s and the nozzle angle is 20o. The blade velocity is 375m/s and the blade velocity coefficient is 0.75. Assuming no loss due to shock at inlet, Calculate for a mass flow of 0.5 kg/s and symmetrical blading i) blade inlet angle ii) driving force on wheel iii) axial thrust on the wheel and iv) power developed by the turbine. | CO3 | 10 |
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| 7. | a. | A single acting reciprocating air compressor has cylinder diameter and stroke of 200 mm and 300 mm respectively. The compressor sucks air at 1 bar and 27oC and delivers at 8 bar while running at 100 rpm. Find indicated power of the compressor, mass of air delivered by the compressor per minute and temperature of the air delivered by the compressor. The compression follows the law pv1.25 = C. Take R as 287 J/kg K. | CO4 | 10 |
| b. | A single stage, single acting reciprocating air compressor with 0.3m bore and 0.4m stroke runs at 400 rpm. The suction pressure is 1 bar at 300K and the delivery pressure is 5 bar. Find the power required to run it, if compression is isothermal, compression follows the law pv1.3 = C and compression is reversible adiabatic. Also find the isothermal efficiency. | CO4 | 10 |
| (OR) | | | | |
| 8. | a. | A single stage reciprocating air compressor is required to compress 1 kg of air from 1 bar to 4 bar. The initial temperature is 27 ºC. Compare the work requirement in the following cases:   1. Isothermal compression, 2. Compression with pv1.2 = C, and 3. Isentropic compression. Take R as 287 J/kg K. | CO4 | 10 |
| b. | Explain the working of a multi stage reciprocating air compressor with a block diagram and write its advantages. | CO4 | 10 |
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|  | | **Compulsory**: |  |  |
| 9. |  | Explain the working principle of vapour absorption refrigeration system with a neat sketch. | CO5 | 20 |