FACULTY OF ENGINEERING

B.E. 3/4 (Mech.) First Semester (Suppl.) Examination, June/July 2011
APPLIED THERMODYNAMICS

Time : Three Hours]　　　　　　　　　　　　　　　　[Maximum Marks : 75

Note :— Answer **ALL** questions from Part—A. Answer any **FIVE** questions from Part—B.

PART—A (Marks : 25)

1. Mention important differences between (i) single-acting and (ii) double-acting reciprocating air compressors.　　　3

2. Distinguish between "intercooling" and "aftercooling" as referred to a reciprocating air compressor.　　　2

3. How can IC engines be categorized on the considerations of (i) number of working strokes per cycle and (ii) method of cooling employed ?　　　3

4. Define "Chemically correct air-fuel ratio" vis-a-vis an SI engine.　　　2

5. Define "pre-ignition" as referred to an SI engine and give its ill effects on the engine performance.　　　3

6. Distinguish between "normal" and "abnormal" combustion in a CI engine.　　　2

7. Mention any three distinguishing features between (i) Locomotive boiler and (ii) Lancashire boiler.　　　3

8. Give any two differences between jet and surface condensers.　　　2

9. Explain, briefly, the "principle of regeneration" vis-a-vis a steam power Rankine cycle.　　　3

10. Mention the various types of steam nozzles used in practice.　　　2

PART—B (Marks : 50)

11. A double-acting, single-stage reciprocating air compressor delivers 0·25 m³/s of air measured at 1·013 bar (abs) and 27°C, and delivers at 7 bar (abs). The conditions at the end of induction stroke are pressure of 0·98 bar (abs) and temperature of 40°C. The clearance volume is 5% of stroke volume and the L/D ratio is 1·3 : 1, while the compressor runs at 300 rpm. Calculate (i) the volumetric efficiency, (ii) cylinder dimensions, (iii) indicated power and (iv) isothermal efficiency of this machine. Take the index of compression and expansion to be 1·3.　　　10

12. With a neat relevant sketch, explain the principle of working of a Battery Ignition System as referred to an SI engine. 10

13. A 2-stroke diseal engine has a bore of 110 mm and a stroke of 150 mm. The engine runs at a mean piston speed of 5 m/s. It develops a torque of 56·3 N-m. The mechanical efficiency of the engine is 80% and the indicated thermal efficiency is 40%. Assuming a calorific value of 44800 kJ/kg for the fuel, calculate (i) ip, (ii) imep, and (iii) bsfc. 10

14. Define "autoignition" vis-a-vis an SI engine. What are all the contributing factors for the same ? Explain the physical meaning of "Octane Number Rating". 10

15. With the aid of a pertinent neat schematic diagram, explain the principle of working of a "Benson Supercritical Steam Boiler". 10

16. A convergent-divergent steam nozzle is required to discharge 2 kg/s of steam. The nozzle is supplied with steam at 10 bar (abs) and 200°C, while the discharge takes place against a back pressure of 0·34 bar (abs). Estimate (i) the throat area and (ii) the exit area. Assume "isentropic flow" and take the index of expansion (n) to be 1·3. If the "nozzle efficiency" is 85%, calculate the exit area. 10

17. Explain, with appropriate schematic, P-v and T-s diagrams, a Rankine Vapour Power Cycle. How can its performance be improved through "Reheating" ? Explain. 10