

**Instructions to candidates**

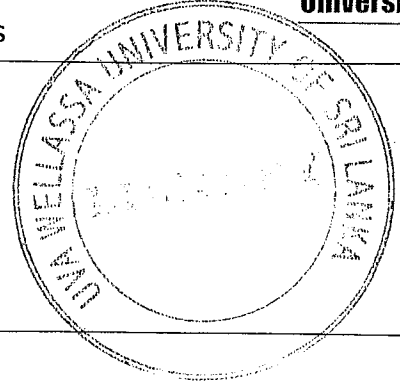
**Duration:** One (01) hours

**Number of questions:** Two (02) Essays

**Mark allocation:** 50

**Answer all questions**

Thermodynamic property tables will be provided.



1.
  - a. State the Kelvin – Planck Statement related to the second law of thermodynamics by giving one practical example (Maximum 100 words) (6 marks)
  - b. The compression ratio of an air-standard Otto cycle is 8.5. Prior to the isentropic compression process, the pressure, temperature and volume of air is 100 kPa, 32°C, and 600 cm<sup>3</sup> respectively. The temperature at the end of the isentropic expansion process is 800 K. Using specific heat value at room temperature as  $R = 0.287 \text{ KPa}\cdot\text{m}^3/\text{kg}\cdot\text{K}$ , determine the following by showing the cycle in P-V and T-S diagrams.
    - i. The highest temperature and pressure in the cycle. (8 marks)
    - ii. The amount of heat transferred in heat addition process, in kJ. (2 marks)
    - iii. The thermal efficiency. (4 marks)
    - iv. The mean effective pressure. (5 marks)
2. Consider a 210-MW steam power plant that operates on a simple ideal Rankine cycle. Steam enters the turbine at 10 MPa and 500°C and is cooled in the condenser at a pressure of 10 kPa. Show the cycle on a T- S diagram with respect to saturation lines, and determine
  - i. The quality of the steam of the turbine exit. (10 marks)
  - ii. The thermal efficiency of the cycle. (10 marks)
  - iii. The mass flow rate of steam (5 marks)