

**KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY**  
*Department of Mechanical Engineering*  
B. Sc. Engineering 2nd Year 1st Term Examination, 2020

**ME 2105**  
(Thermodynamics)

Time: 1.5 Hours

Total Marks: 120

- N.B.:** i) Answer any TWO questions from each section in separate scripts.  
ii) Figures in the right margin indicate full marks.  
iii) Assume reasonable data if any missing.

**SECTION-A**

- 1(a) State zeroth law of thermodynamics. Why this law is considered as the basis for temperature measurement? 07
- 1(b) "Any quantity of heat supplied to a system is utilized to increase the internal energy of the system and the work done by the system". Justify the statement. 10
- 1(c) There are 1.45 kg of a gas, for which  $R = 0.375 \text{ kJ/kgK}$  and  $k = 1.25$ , that undergo a non-flow constant volume process from  $p_1 = 540 \text{ kPa}$  and  $t_1 = 55^\circ\text{C}$  to  $p_2 = 1600 \text{ kPa}$ . During the process the gas is internally stirred, and there are also added 100 kJ of heat. Determine  $t_2$ ,  $Q$ ,  $\Delta U$  and work output. 13
- 2(a) What are the limitations of 1st law of thermodynamics? Write the statement for 2nd law of thermodynamics as proposed by Kelvin-Planck's. 10
- 2(b) What is meant by reversibility? What factors render a process irreversible? Explain. 10
- 2(c) State and prove Clausius inequality principle. 10
- 3(a) What is meant by air-standard cycle? Derive the expression for dual cycle in terms of different ratios. 10
- 3(b) For same maximum temperature and same heat addition, show that Diesel cycle performs better than Otto cycle. 05
- 3(c) An engine operating on air standard diesel cycle, the percentage clearance is 6.25% and at the beginning of isentropic compression, the temperature is  $26^\circ\text{C}$  and the pressure is 0.1 MPa. Heat is added until the temperature at the end of constant pressure is  $1650^\circ\text{C}$ . Calculate – (i) compression ratio; (ii) cut off ratio; (iii) heat added and (iv) heat rejected. 15

**SECTION-B**

- 4(a) What should be the characteristics of a vapour power cycle? Explain the effect of steam reheating with the help of T-s diagram. 10
- 4(b) Why do binary vapour cycle useful in power generation? Explain a typical binary vapour power cycle with neat sketch. 10
- 4(c) Prove that when the maximum temperature is fixed and steam quality at outlet from the turbine is fixed, the maximum boiler pressure is also fixed. 10
- 5(a) Why do we feel sweat in summer and dry in winter? Explain. 06
- 5(b) Derive an expression for specific humidity and show that it is a function of vapour pressure and barometric pressure. 10
- 5(c) What is adiabatic saturation process? Show that for adiabatic saturation process, the enthalpy of the mixture remain constant. 14

- 6(a) Define and classify fuel. Distinguish between higher and lower calorific value of fuel. Also, mention their relationship. 06
- 6(b) Why do we need modification of solid waste's to use as a fuel? Describe any one process for modification of solid waste's to convenient solid fuel. 10
- 6(c) A mixture of gases consists of 3.6 kg of  $N_2$  and 5.8 kg of  $CO_2$  at a pressure of 300 kPa and temperature of  $21^\circ C$ . Calculate- (i) the mass fraction and mole fraction of each constituent, (ii) the equivalent molecular weight of the mixture and (iii) the  $C_p$  and  $C_v$  of the mixture. Consider  $\gamma$  for  $CO_2$  and  $N_2$  are 1.29 and 1.39 respectively. 14

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**EE 2105**  
(Electronics)

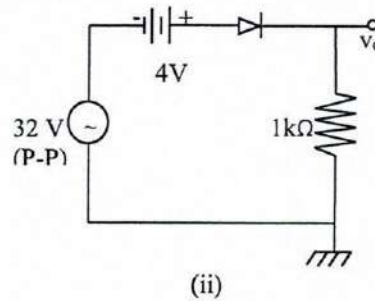
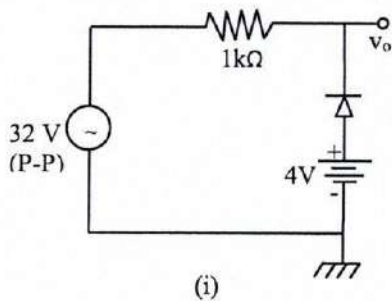
Time: 1.5 Hours

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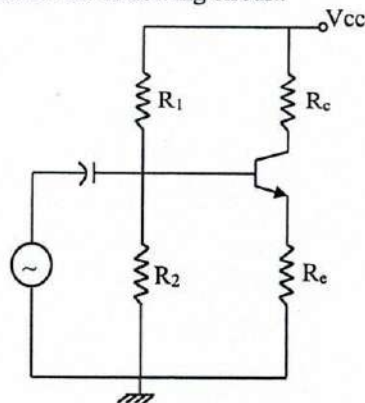
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**SECTION-A**

- 1(a) Compare metal, semiconductor and insulator. Why electrons have greater mobility than holes? 12
- 1(b) Explain how Zener diode acts as a voltage regulator? 10
- 1(c) Draw the output waveforms of the following networks as shown in the figure. 08



- 2(a) Mention the differences between half and full wave rectifier. 07
- 2(b) Design procedure of a regulated power supply is needed. How will you do it? 13
- 2(c) What are D, E and C-MOS? Mention three differences between D and E-MOS. 10
- 3(a) A BJT can be used as a switch. Validate the statement. 10
- 3(b) Draw the DC load line for the following circuit. 08



- 3(c) What are SCR and DIAC? Briefly explain. 12

**SECTION-B**

- 4(a) Mention the names of basic logic gates. Write their truth-tables. 12
- 4(b) What are the universal gates? Why are they named so? 05
- 4(c) Show that "A full-adder can be implemented with two half-adders and one OR gate". Prove that NAND and NOR gates are universal gates. 13

- 5(a) Mention the differences between combinational circuit and sequential circuit. "JK flip-flop is the refinement of RS flip-flop"- Justify the statement. 10
- 5(b) What is the difference between register and Latch? Draw a 4-bit register using D flip-flops and explain its working principle. 10
- 5(c) What are the limitations of a ripple counter? Draw a 4-bit binary ripple counter and explain its working principle. 10
- 6(a) Define a BCD-to-excess-3 code converter. 08
- 6(b) Design a dc power supply to meet the following specification from 1- $\phi$  ac mains (220V, 50Hz). Also identify the important test points and hence draw their wave shapes. 14  
(i) 9V, 100mA, (ii) -6V, 150 mA and (iii) +12V, 300 mA.
- 6(c) Draw the block diagram of microprocessor and microcontroller. 08