AIR FORCE INSTITUTE OF TECHNOLOGY
FACULTY OF GROUND AND COMMUNICATION ENGINEERING
DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING
SECOND SEMESTER EXAMINATION 2020/2021
B.sc IN ELECTRICAL & ELECTRONIC ENGINEERING

Course Title:	ANALOGUE ELECTRONICS
Course Code:	EEE 306
Credit Unit:	2 Units
Instruction:	ANSWER ANY FOUR QUESTION OUT OF SIX (6)
Duration:	2 HOURS
Date:	25th January, 2022

Question 1

a. Give two areas of application of bipolar junction transistors (BJT). **(2 marks)**
b. Accompanied with a clear diagrams give a concise description of NPN and PNP transistors. **(5 marks)**
c. Define the following part of transistors
   i. Base, **(2 marks)**
   ii. Emitter and, **(2 marks)**
   iii. Collector. **(2 marks)**
d. For proper working of a transistor, what are the golden rules in biasing it? **(2 marks)**

Question 2

a. With the aid of a diagram, explain what is a pn junction **(3 marks)**
b. With the aid of diagrams differentiate between forward and reverse bias of pn junction **(6 marks)**
c. Explain the following terms
   i. Depletion region **(2 marks)**
   ii. Potential barrier **(2 marks)**
   iii. Built-in potential **(2 marks)**

Question 3

a. Draw a diagram showing a common emitter configuration of a bipolar transistor and derive the equations relating α and β. **(5 marks)**
b. In a common base configuration, current amplification factor is 0.9. if the emitter current is 1mA, determine the value of base current **(5 marks)**
c. In a common base configuration, $\alpha = 0.95$. The voltage drop across a 2kΩ resistor which is connected in the collector is 2V. find the base current. **(5 marks)**

Question 4

For the following Voltage regulating circuit diagram below in Fig 1, Provide (Draw clearly) the complete circuit to represent

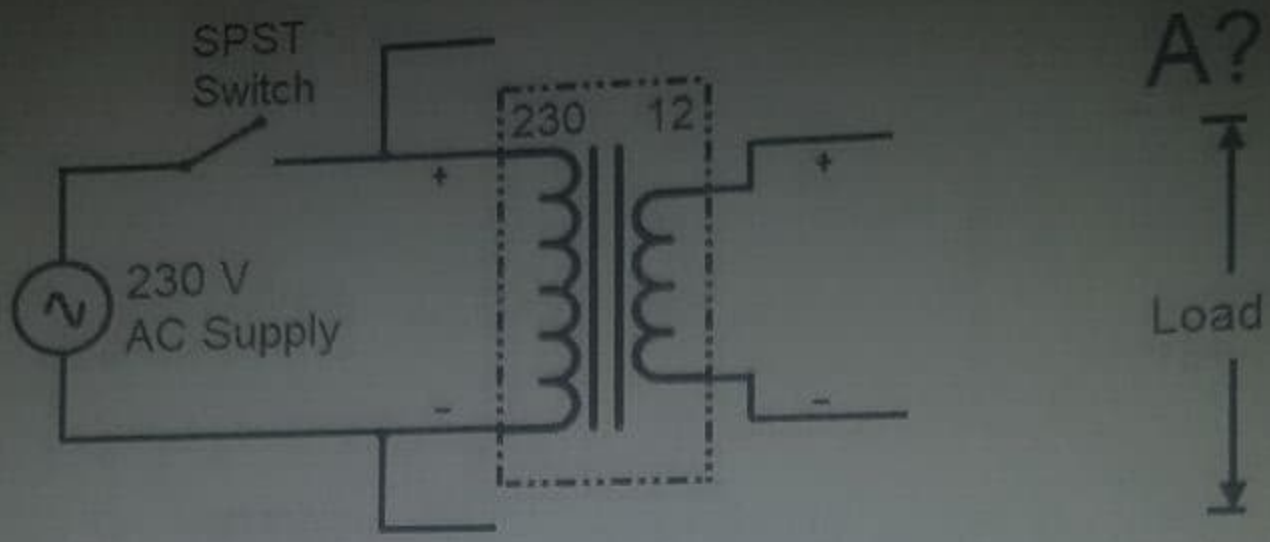

Fig. 1

a. Voltage Buck Operation **(2 marks)**

b. Voltage Boost Operation **(2 marks)**

c. Explain Voltage regulation with Buck operation and calculate the value of A for Buck Operation **(3 marks)**

d. Explain Voltage regulation with Boost operation and calculate the value of A for Boost Operation **(3 marks)**

e. Stabilizers are typically high efficiency devices which generally operate in what efficiency range? **(1 marks)**

f. List two consequences of Over Voltage in Electronic Equipment **(2 marks)**

g. List two consequences of Under Voltage in Electronic Equipment **(2 marks)**

Question 5

a. With a well labeled diagram explain what you understand by the term operational amplifier **(3 marks)**

b. Draw clearly the circuit symbol of an operational amplifier showing both the inverting and non-inverting terminals **(3 marks)**

c. State the configuration in which an operational amplifier operates **(3 marks)**

d. With the aid of a well labeled circuit diagram, explain the term Virtual grounding in an operational amplifier **(3 marks)**

e. Explain in details the reason why input voltage (Vi) is reduced to almost zero in an operational amplifier **(3 marks)**

Question 6

a. Find the value of output voltage of an operational amplifier as an inverting adder for the following sets of input voltages and Resistance, in all cases $R_F = 1M\Omega$ **(3 marks)**
$V_1 = -3V$, $V_2 + 3V$, $V_3 = +2V$, $R_1 = 250K\Omega$, $R_2 = 500K\Omega$, R_3 $1M\Omega$

b. A $5Mv_1$ $1KH_z$ sinusoidal signal is applied to the input terminals of an op-amp integrator for which $R = 100K\Omega$ and $C = 1\mu f$. Calculate the output voltage. **(3 marks)**

c. Design an operational amplifier circuit that will produce an output equal to $-(4v_1 + v_2 + 0.1v_3)$ and write an expression for the output. also sketch its output wavefrom when $V_1 = 2SinWt$, $V_2 = +5v$ and $V_3 = -100V$ dc **(3 marks)**

d. Show clearly the circuit diagram of an operational amplifier as an integrator (mathematical expression required) **(3 marks)**

e. Show with mathematical expression, and circuit diagram how to obtain a differentiator as an operational amplifier. **(3 marks)**