B.E. ELECTRICAL ENGINEERING FIRST YEAR
SECOND SEMESTER EXAM 2019 (OLD)

ELECTRONICS – I **Time: Three hours** **Full Marks: 100**

Use a separate Answer-Script for each Part (50 marks for each Part)

(Write answers of all parts of a question together)

PART-I

Answer ***Q.1*** and any ***two*** questions from the rest [10+2×20=50]

Module-I

Answer any ***five*** from the following : [2×5=10]

1. a) Name two current conduction mechanisms in semiconductors.
   b) Define built-in potential of a p-n junction diode.
   c) Define α and β of a bipolar junction transistor.
   d) What is pinch-off voltage of JFET?
   e) Mention some advantages of MOSFETs over BJTs.
   f) Define class AB operation of power amplifier.
   g) What are the dimensions of different hybrid parameters?

Module-II

Answer any two [20×02=40]

2. a) How will you convert an intrinsic semiconductor into an n-type semiconductor? [3]
   b) Write down Fermi Dirac Distribution function and explain each term. [5]
   c) Sketch the Fermi Dirac distribution function at absolute zero temperature (0 K), at T= 150 K and at room temperature (300 K). (Qualitative hand drawing) Explain. [6]
   d) Draw the energy band diagram of a PN junction diode in thermal equilibrium, under forward bias and reverse bias conditions. [6]

3. a) Draw, explain the operation and determine the value for rectification efficiency of a centre-tapped full wave rectifier. [3+5+2]

b) Draw a series positive diode clipper circuit. Explain its operation. [5]

c) The circuit given below (Fig. 1) has a input voltage V_{in}=220V, R=1 KΩ and the load having resistance R_L=5KΩ. If the Zener voltage V_Z=30V. Find the current through R (I), Zener current (I_Z) and load current (I_L). [5]

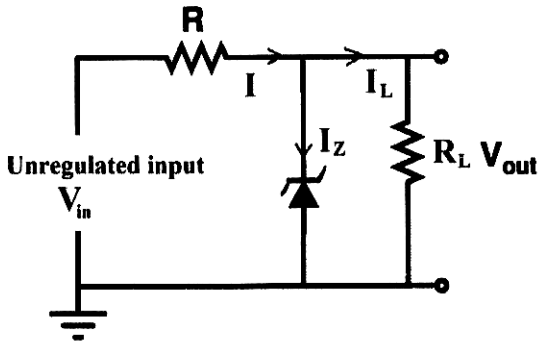

Figure 1

4. a) Draw and explain the input and output characteristics of a bipolar junction transistor operated in common emitter (CE) mode. [8]

b) Draw and explain the operation of a series fed class A power amplifier. Hence prove that the maximum power conversion efficiency of the class A power amplifier is 25 %. [8]

a) Explain the pinch-off phenomenon in JFET with a neat diagram. [4]

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(1st year, 2nd Semester)

Subject: Electronics-I

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No. of questions	**PART- II** Answer **question no. 6** and any **two from the rest**	Marks
6.	Answer ***any five*** questions: a. How the Bandwidth of an amplifier is enhanced due to application of negative feedback? b. How the ***noise*** of an amplifier is more reduced for the application of negative feedback? c. Mention the ideal and practical characteristics of an Operational amplifier? d. Distinguish between inverting and non-inverting Operational amplifier. e. Why indirect band gap semiconductors are not used to fabricate LED? f. How noise is cancel out for a differential amplifier? g. Define virtual short and virtual ground. h. How an operational buffer amplifier is designed? i. Why the output of a practical OPAMP is not zero when two equal voltages are applied at the two input terminals?	5x2=10
7.	a) How the amplifier characteristics are changed due to the application of negative feed-back? b) Derive the expressions for lower and upper half power frequencies for an amplifier with negative feedback. Show that lower half power frequency with feedback is less than the lower half power frequency without feedback and upper half power frequency with feedback is greater than the upper half power frequency without feedback. How the frequency distortion of an amplifier is reduced with the application of negative feedback. Sketch the frequency response for an amplifier with and without feedback. c) Determine the voltage gain, input and output impedance for an amplifier with voltage shunt feedback having R_i = 12 KΩ, R_O = 18 KΩ and β = -0.5. d) Draw a circuit for a voltage shunt feedback using BJT and explain how this topology of feedback is occurred in this circuit?	2+(3+3+2+3)+3+4
8.	a) Draw an OPAMP precision rectifier circuit and explain its operation. b) Why an OPAMP comparator circuit is required? b) Design an OPAMP circuit to generate the output voltage is proportional to the algebraic sum of the input voltages. c) Design an OPAMP circuit to generate the Sine wave at its output. d) For an OPAMP differential circuit has the following parameters. $R_1 = R_2$ = 1.0 KΩ and $R_F = R_3$ = 10.0 KΩ (the symbol have their usual meaning). Calculate the gain and input resistance of this circuit.	(2+3)+2+(3+3)+3+4

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9.	a) Define the common mode rejection ratio (CMRR). What is the significance of this term? b) Design a ***sawtooth*** waveform generator using OPAMPs and explain the operation of the circuit. b) Write short notes (any ***two***) of the following: i) Schmitt Trigger circuit using OPAMP ii) Liquid crystal display (LCD) iii) Photoconductive cell iv) Photo-diode	(2+2)+6+(5 x 2)
10.	a) Write down the working principle of a ***Light Emitting Diode (LED)*** with suitable energy band diagram. b) How ***Bird*** can be display using 7-Segment display? c) Sketch the output current-voltage characteristics of a **photo-transistor** and explain the nature of this curve. d) Write down the working principle of **Opto-couplers**.	5+5+6+4