



HERITAGE INSTITUTE OF TECHNOLOGY

B.Tech.

Class test I

Examination 2016

Session : 2015 - 16

Discipline : AEIE/CSE/ECE/IT

Paper Code : ECEN 1001

Paper Name : Basic Electronics Engineering

Time Allotted : 1 hr

Full Marks : 30

Figures out of the right margin indicate full marks.

Answer all the questions

Candidates are required to give answer in their own words as far as practicable.

1. (a) Write the mathematical expressions in order to describe mobility, current conductivity and total conduction current density. (1+1+2)
(b) Calculate the percentage decrease of resistivity of pure germanium at 300K if it is doped with arsenic having concentration of $3.5 \times 10^{20} \text{ m}^{-3}$ given $n_i = 2.33 \times 10^{19} \text{ m}^{-3}$, $\mu_n = 0.39 \text{ m}^2/\text{Vs}$, $\mu_p = 0.19 \text{ m}^2/\text{Vs}$. (6)
2. (a) With the help of a circuit diagram explain the working of a half wave rectifier. Show the relevant waveforms. Obtain the expression for efficiency and ripple factor. (2+1+4)
(b) Differentiate between centre tapped and bridge full wave rectifier. (2)
(c) Define Peak Inverse Voltage. (1)
3. (a) Can two pn-junction diodes placed back to back act as a transistor? Justify your answer. (3)
(b) Draw and explain the input and output characteristics of an npn transistor in Common Base mode (7)



HERITAGE INSTITUTE OF TECHNOLOGY

B-Tech 1st year 2nd Semester Examination, 2016 CLASS TEST -I Session : 2015-16
 Discipline : AEIE/ BT/ CE/ CHE/ CSE/ ECE/ EE/ IT/ ME

Paper Code : MECH 1201

Paper Name : ENGINEERING THERMODYNAMICS & FLUID MECHANICS

Time: 1 hr

Full Marks – 30

Answer all the questions

1. Choose the most appropriate option/fill up the blank as the case may be:

[1 × 10 = 10]

- (i) First law of thermodynamics is the law of conservation of
 - (a) mass
 - (b) energy
 - (c) work
 - (d) heat
- (ii) Internal energy of a system is a
 - (a) path function
 - (b) point function
 - (c) may both path and point function
 - (d) none of these
- (iii) Among the possible choices given below, maximum work done during the expansion of a gas, is obtained when the process takes place at
 - (a) constant pressure
 - (b) constant volume
 - (c) constant temperature
 - (d) adiabatic condition
- (iv) Heat transferred to a closed stationary system at constant pressure is equal to
 - (a) Work transfer
 - (b) increase in internal energy
 - (c) increase in enthalpy
 - (d) None of these
- (v) Referred to a compressor as an SFEE device, the work transfer is:
 - (a) Positive
 - (b) Negative
 - (c) Can be positive or negative
 - (d) None of these
- (vi) In the polytropic process given by the equation $p v^n = \text{constant}$, if 'n' is infinitely large, the process is termed as
 - (a) isochoric
 - (b) isobaric
 - (c) adiabatic
 - (d) isothermal
- (vii) Newton's law of viscosity for a fluid states that the shear stress is
 - (a) proportional to angular deformation
 - (b) inversely proportional to angular deformation
 - (c) proportional to rate of angular deformation
 - (d) inversely proportional to rate of angular deformation
- (viii) Specific gravity of 1 litre of a liquid having weight 8 N, is _____ [Take 'g' = 9.81 m/s²]
- (ix) Kinematic viscosity has dimension of
 - (a) $L^{-2}T^1$
 - (b) L^2T^{-1}
 - (c) $ML^{-1}T^{-1}$
 - (d) $L^{-1}T^2$
- (x) For a fluid at rest, the shear stress
 - (a) may have any positive value
 - (b) depends upon the viscosity
 - (c) is zero
 - (d) is infinity

2 (a) State Zeroth Law of Thermodynamics.

[2]

(b) At the inlet to a certain nozzle, the enthalpy of the fluid passing is 3000 kJ/kg and the velocity is 60 m/s. At the discharge end, the enthalpy is 2762 kJ/kg. The nozzle is horizontal and there is negligible heat loss from it. (i) Find the velocity at exit from the nozzle. (ii) If the inlet area is 0.1 m² and the specific volume at inlet is 0.187 m³/kg, find the mass flow rate. (iii) If the specific volume at the nozzle exit is 0.498 m³/kg, find the exit area of the nozzle.

[3+3+2]

3(a) A piston cylinder arrangement contains an ideal gas (CO₂) at 300 kPa and 200°C and occupies a volume of 0.2 m³. The gas undergoes a quasi-static expansion, according to the relation $PV^{1.3} = \text{constant}$, until the final temperature become 100°C. Determine the work done during the process.

[4]

(b) A square plate of with surface area (600 mm × 600 mm) and mass 25 kg slides down a plane inclined at 30° with horizontal, at a constant velocity of 0.30 m/s. There is an oil film of 1 mm thickness between the plate and the inclined surface. Find the dynamic viscosity of the oil.

[6]



HERITAGE INSTITUTE OF TECHNOLOGY

Class test I

Examination 2016

Session : 2015 – 2016

Discipline : AEIE, CSE, ECE, IT

Paper Code : PHYS 1001.

Paper Name: PHYSICS I

Time Allotted: 1 hr

Full Marks: 30

Figures out of the right margin indicate full marks.

Answer all the questions

Candidates are required to give answer in their own words as far as practicable.

1 (a)	A polarizer and an analyzer are oriented so that the maximum intensity is achieved. What fraction of the maximum intensity is reduced when the analyzer is rotated through 60° ?	(3) + (2) + (2) + (3) = 10
(b)	A ray of light is incident on the surface of a glass plate of refractive index 1.732 at polarizing angle. Calculate the corresponding angle of refraction of the ray.	
(c)	Write a short note on Positive and Negative Crystal.	
(d)	When a thin sheet of transparent material of thickness $0.33\text{ }\text{\AA}$ is introduced in one of the interfering beams, the central fringe shifts to a position occupied by the sixth bright fringe, when there was no plate. If $\lambda = 6 \times 10^{-5} \text{ cm}$, find the refractive index of the sheet.	
2 (a)	What do you mean by coherent sources? Justify that Interference phenomena obey energy conservation principle.	(1+2) + (2) +(1+1)+(3) = 10
(b)	Find the momentum of an electron whose kinetic energy equals its rest energy of 511keV.	
(c)	Show graphically, how the energy density varies with frequency of black body radiation for different temperatures. State Wien's displacement law from the characteristics of black body radiation.	E \propto ν^3 $E \propto \frac{1}{\nu^2}$ $E \propto \frac{1}{\nu^3}$
(d)	Derive the average energy of the oscillator having frequency ' ν ' of the blackbody under the assumption of Planck's hypothesis.	
3 (a)	Show that $\sin(ax - bt + \beta)$ satisfies wave equation $\frac{\partial^2 \psi}{\partial x^2} = \frac{1}{c^2} \frac{\partial^2 \psi}{\partial t^2}$ and hence identify the wave velocity. Here β is a dimensionless constant.	(2)+(3) + (3) + (2) = 10
(b)	A crystal of Cu is FCC. Given that the radius of a Cu atom is 0.128 nm, find the density of Cu. Atomic weight of Cu is 63.55 amu.	
(c)	MgO has the rock salt (NaCl) structure. Given that the radii of the Mg^{2+} and O^{2-} ions are 0.072 nm and 0.140 nm respectively, find the atomic packing factor for MgO. Atomic weights are 24.31 amu (Magnesium) and 16.00 amu (Oxygen).	$N = 1 + \frac{6}{\pi}$
(d)	Sketch the directions [111] and [102].	

Duration: 1 hour Discipline: AE, BT, CE, ChE, CSE, ECE, EE, IT, ME Full Marks: 30

*Figures out of the right margin indicate full marks.**Answer all the questions**Candidates are required to give answer in their own words as far as practicable.*

1	<p>What would be the output of the following programs (i to iv): (2+2+1+1)</p> <p>(a)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; vertical-align: top;"> <pre>(i) #include <stdio.h> void f(int a[], int n){ int i; for (i = 0; i < n - 1; ++i) a[i] += a[i+1]; } int main(){ int a[5] = {1, 2, 4, 6, 8}; f(a, 4); printf("%d", a[4] - a[3]); return 0; }</pre> </td><td style="width: 50%; vertical-align: top;"> <pre>(ii) #include <stdio.h> int n = 10; void fgh (int r) { printf("%d,%d\n",n,r); } int main () { int n = 20; fgh(n); }</pre> </td></tr> <tr> <td style="vertical-align: top;"> <pre>(iii) #include<stdio.h> void main() { float *ptr; printf("%d", sizeof(ptr)); getch(); }</pre> </td><td style="vertical-align: top;"> <pre>(iv) #include<stdio.h> void main() { int a=4; int * p,* q; p=&a; q= p * 4; printf("%d",*(q)); }</pre> </td></tr> </table>	<pre>(i) #include <stdio.h> void f(int a[], int n){ int i; for (i = 0; i < n - 1; ++i) a[i] += a[i+1]; } int main(){ int a[5] = {1, 2, 4, 6, 8}; f(a, 4); printf("%d", a[4] - a[3]); return 0; }</pre>	<pre>(ii) #include <stdio.h> int n = 10; void fgh (int r) { printf("%d,%d\n",n,r); } int main () { int n = 20; fgh(n); }</pre>	<pre>(iii) #include<stdio.h> void main() { float *ptr; printf("%d", sizeof(ptr)); getch(); }</pre>	<pre>(iv) #include<stdio.h> void main() { int a=4; int * p,* q; p=&a; q= p * 4; printf("%d",*(q)); }</pre>	6+ 1X 4
<pre>(i) #include <stdio.h> void f(int a[], int n){ int i; for (i = 0; i < n - 1; ++i) a[i] += a[i+1]; } int main(){ int a[5] = {1, 2, 4, 6, 8}; f(a, 4); printf("%d", a[4] - a[3]); return 0; }</pre>	<pre>(ii) #include <stdio.h> int n = 10; void fgh (int r) { printf("%d,%d\n",n,r); } int main () { int n = 20; fgh(n); }</pre>					
<pre>(iii) #include<stdio.h> void main() { float *ptr; printf("%d", sizeof(ptr)); getch(); }</pre>	<pre>(iv) #include<stdio.h> void main() { int a=4; int * p,* q; p=&a; q= p * 4; printf("%d",*(q)); }</pre>					
(b)	What is the output of the following program?					
	<pre>#include<stdio.h> int main() { int s=2,*r=&s,**q=&r,***p=&q; printf("%d", p[0][0][0]); return 0; }</pre>	(A) Compiler Error (B) Garbage Value (C) Runtime Error (D) 2				
(c)	Let the array A be initialized as: char A[10] = "HIT2016"; What is the content of A[7]?					
	(A) '0' (B) '\0' (C) '6' (D) Cannot be determined.					
(d)	Distinguish between int *p[] and int (*p)[].					
(e)	Write, in brief, the difference between malloc() and calloc().					
2.	<p>a) Write a program in C that takes a name, consisting of First_name and Surname, as input to a single string and generates a gmail id of type SurnameFirst_name@gmail.com. For example, if the input is Sachin Tendulkar the output will be TendulkarSachin@gmail.com. (you are not allowed to use any function of string.h).</p> <p>b) Write a program in C to Add Two Complex Numbers by Passing Structure to a Function.</p>	6+4				
3.	<p>a) Write a program using pointers to read a set of integers and store it dynamically then print the integers in reverse order.</p> <p>b) Consider the following recursive function. Assume that both n, k are positive.</p> <pre>int S(int n, int k) { if(k > n) return 0; if((k == 1) (k == n)) return 1; return S(n-1,k-1) + k * S(n-1,k); }</pre> <p>What is the value returned by S(5,3)? Show your calculations.</p>	5+5				



HERITAGE INSTITUTE OF TECHNOLOGY

B.Tech.

Class test II

Examination 2016

Session : 2015 - 16

Discipline : ECE, AEIE,CSE,IT

Paper Code : ECEN 1001

Paper Name : Basic Electronics Engineering

Time Allotted : 1 hr

Full Marks : 30

Figures out of the right margin indicate full marks.

Answer all the questions

Candidates are required to give answer in their own words as far as practicable.

1. (a) Write down the characteristics of a practical OPAMP. (3)
(b) A 5mV, 1 kHz sinusoidal signal is applied to the input of an op-amp integrator for which $R=100k\ \Omega$ and $C=1\mu F$. Calculate the output voltage at any instant of time. (4)
(c) State and explain the condition for sustained oscillation. (3)

2. (a) Differentiate between BJT and FET. (3)
(b) Draw the output characteristics of n channel depletion type MOSFET indicating the different regions and different mode in the sketch. (3)
(c) An n channel JFET has $I_{DSS} = 12mA$ and pinch-off voltage $V_P = - 4V$. Find the drain current for $V_{GS} = - 2V$. If the transconductance g_m of a JFET with the same I_{DSS} at $V_{GS} = 0V$ is 4 millimho, find the pinchoff voltage. (4)

3. (a) Draw the circuit diagram of self bias BJT amplifier. Why is the circuit so named? (4)
(b) What do you mean by thermal runaway? (2)
(c) An npn transistor is used as CE amplifier and has the collector to base bias arrangement. Given $\beta = 99$, $V_{BE} = 0.7V$, $V_{CC} = 12V$, $R_L = 2K\Omega$, $R_B = 100\ K\Omega$. Find the Q-point of the above amplifier. (4)



HERITAGE INSTITUTE OF TECHNOLOGY

B.Tech 1st year Class Test II

2016

Session: 2015-16

Discipline : CSE, IT, ECE, AEIE, BT, CHE, CE, ME, EE

Paper Code : MATH 1201

Paper Name : MATHEMATICS II

Time Allotted : 1 hr

Full Marks : 30

Figures out of the right margin indicate full marks.

Answer all the questions

Candidates are required to give answer in their own words as far as practicable.

1 (a)	Find the image of the point $(-3,8,4)$ in the plane $6x - 3y - 2z + 1 = 0$.	3+ 6+1
(b)	Solve, the following differential equation by using Laplace transform $\frac{d^2y}{dt^2} + 9y = \cos 2t$, if $y(0) = 1, y(\pi/2) = -1$	
(c)	If $f(t)$ is a periodic function with period T , then $L\{f(t)\} = \dots$?	
2 (a)	Find by Prim's Algorithm a minimal spanning tree for the following graph.	6+ 4
(b)	Solve, the following ordinary differential equation: $\frac{d^2y}{dx^2} - 5 \frac{dy}{dx} + 6y = x^2 e^{3x}$	
3 (a)	Find the equation of the planes bisecting the angle between the planes $3x - 4y + 12z = 26$, $x + 2y - 2z = 9$ and distinguish them.	5 + 3 + 2
(b)	Find the general and singular solution of $y = px + p^2$, where $p = \frac{dy}{dx}$	
(c)	A graph G has 15 vertices and 20 edges. What is the least number of edges that are to be removed from G to make it a tree ?	

$$I = \int_{-\infty}^{\infty} f(t) e^{-st} dt$$



HERITAGE INSTITUTE OF TECHNOLOGY

.....2nd ... Class test I / II / III Examination 2016..... Session :2015 - 2016.....

Discipline :B. Tech....(AEIE, CSE, ECE, IT)....

Paper Code : ...PHYS 1001..... Paper Name:PHYSICS I.....

Time Allotted:1 hr

Full Marks:30

Figures out of the right margin indicate full marks.

Answer all the questions

Candidates are required to give answer in their own words as far as practicable.

1 (a)	Starting from the relation of intensity distribution of Fraunhofer diffraction due to a single slit obtain the conditions for principal maximum, secondary maxima and minima. Hence show that the intensity of the 1 st secondary maximum is about 4.5% of the principal maximum.	(4) + (1) + (2) + (3) = 10
(b)	The width of each slit of a double-slit is 0.15mm and they are separated by a distance of 0.45mm. If double-slit produces Fraunhofer diffraction pattern, find the missing orders.	
(c)	The faces of a quartz plate are cut parallel to the optic axis of the crystal. What is the minimum thickness of the plate that would serve to put the ordinary and extra-ordinary rays of $\lambda=5890\text{\AA}$ a half wave apart on their exit. [Given that $\mu_e = 1.553$ and $\mu_o = 1.544$]	
(d)	Establish the relation between the scattering angle and recoiled angle of Compton Effect.	
2(a)	Deduce the relation between group velocity and phase velocity in terms of wavelength.	(2) + (3) +(1)+(2) +(2)= 10
(b)	Show that the de-Broglie wavelength of a particle, of charge 'e' rest mass m_0 , moving at relativistic speeds is given as a function of the accelerating potential V as, $\lambda = \frac{h}{\sqrt{2m_0 eV}} \left(1 + \frac{eV}{2m_0 c^2}\right)^{-\frac{1}{2}}$	
(c)	Write down the differential equation for damped harmonic oscillator.	
(d)	Show that $y = (A + Bt)e^{-\beta t/2m}$ is the solution of the following differential equation for critically damped vibration, $\frac{d^2y}{dt^2} + \frac{\beta}{m} \frac{dy}{dt} + \frac{k}{m} y = 0$	
(e)	In damped harmonic oscillator, calculate the time in which the energy of the system falls to e^{-1} times of its initial value	
3 (a)	Obtain the condition for displacement amplitude resonance in case of forced harmonic oscillation.	(2)+(4) + (2) + (1+1)= 10
(b)	Cu crystal (FCC) has a density of 8.96 g/cm ³ . The atomic weight of Cu is 63.55 a.m.u. If the glancing angle for the first order diffraction is 11° on the (100) planes, calculate the wavelength of X-rays. [Avogadro Number = 6.02x10 ²³]	
(c)	Plot the planes (1̄1̄1) and (120).	
(d)	Write down the relation between Einstein's A and B coefficients in laser transitions and their physical significance.	



HERITAGE INSTITUTE OF TECHNOLOGY

B.Tech Class test I 2016

Session: 2015-16

Discipline : CSE, IT, ECE, AEIE, BT, CHE, CE, ME, EE

Paper Code : MATH 1201

Paper Name : MATHEMATICS II

Time Allotted : 1 hr

Full Marks : 30

Figures out of the right margin indicate full marks.

Answer all the questions

Candidates are required to give answer in their own words as far as practicable.

1 (a)	Show that the equation of the plane through the point (x_1, y_1, z_1) and perpendicular to both the planes $a_1x + b_1y + c_1z + d_1 = 0$ and $a_2x + b_2y + c_2z + d_2 = 0$ can be expressed as $\begin{vmatrix} x - x_1 & y - y_1 & z - z_1 \\ a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \end{vmatrix} = 0.$	4+3+3=
(b)	How many vertices are necessary to construct a graph with exactly 12 edges in which each vertex is of degree 3?	
(c)	Solve the differential equation: $2(1 - xy) \frac{dy}{dx} = y^2$	
2 (a)	Examine the convergence of the following integral $\int_0^1 \frac{dx}{x(\log x)^2}$	5+5=10
(b)	Solve the differential equation : $(2x \log x - xy)dy + 2ydx = 0$	
3 (a)	Let G be a graph such that the degree of every vertex of it is r, where r is an odd integer. Show that the number of edges of G is a multiple of r.	4+3+3=
(b)	Find $L\{e^{3t} \sin^2 t\}$	
(c)	Find, in what ratio the yz plane divides the straight line joining the points $(3, 5, -7)$ and $(-2, 1, 8)$ and hence find the point of intersection of the yz plane with the straight line.	

$$n=0$$

X