INDIAN INSTITUTE OF SPACE SCIENCE AND TECHNOLOGY

Department of Avionics

AV121 – Basic Electronics

First Year (common to all branches)

Quiz #3 (II semester)

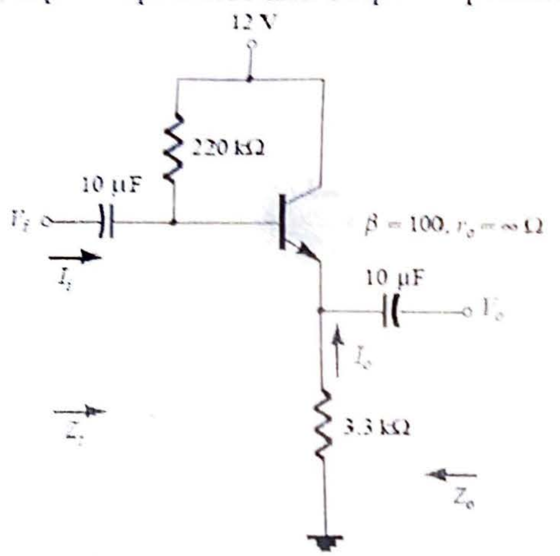
07/04/2015 **Maximum Marks: 30**

Answer **ALL** Questions

(Answer Part A and Part B in separate sheets)

Part-A

1. Draw the r_e model of the given CC amplifier shown in Fig.1. Compute the value of voltage gain, input impedance and output impedance. (assume V_T=26mV) [6]



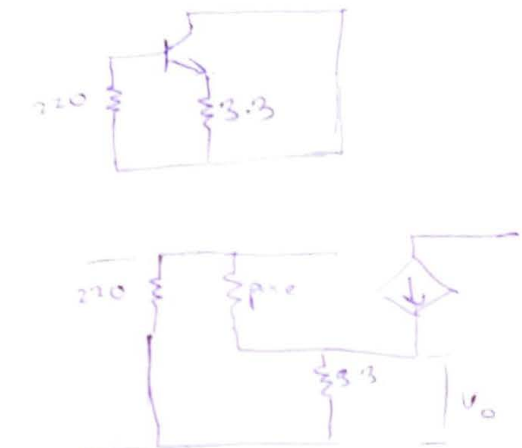


Fig.1

2. A particular enhancement MOSFET for which V_t=1V and K=0.05 mA/V^2 is to be operated in the saturation region. If I_D is to be 0.2mA find the required V_{GS} and minimum required V_{DS}? [3]

3. A certain JFET data sheet gives $(V_{GS})_{off}$=-8V and I_{DSS}=10mA. When V_{GS}=0, what is I_D for values of V_{DS} above switch off? V_{DD}=15V. [2]

4. For the JFET shown below in Fig.2, Vp=-4v and I_{DSS}=12mA. Determine the minimum value of V_{DD} required to put the device in saturation region. [4]

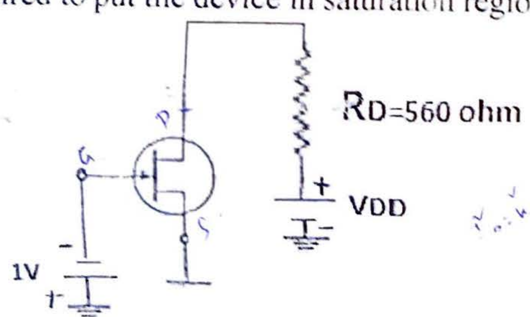


Fig.2

$I_D = I_{DSS}\left(1-\frac{V_{GS}}{V_P}\right)^2$

$I_D = k(V_{GS}-V_t)^2$

$V_{GS}-V_{DS}=V_t$

$V_{DS} < V_{DD}$

Part-B

1. Add BCD numbers [2]
   a. 0100 + 0101
   b. 1001+0111
2. What do you understand by the term 0-level and 1-level noise margin of a standard TTL IC. Explain with proper figures and specifications for a standard TTL IC. [3]
3. What do you understand by the term "A debounce switch". Use SET/RESET NOR flip flop to avoid debouncing. [3]
4. Assuming that Q=0 initially, apply the SET and RESET waveforms shown in Figure 1 to the SET and RESET input of a NAND and NOR flip flop, and determine the Q and $\bar{Q}$ waveforms. [3]

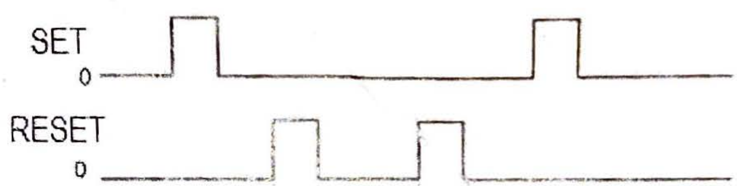


Figure 1

5. Explain following terms [4]
   a. TTL fan-out
   b. Time propagation LOW-to-HIGH
   c. Difference between Active high mode and active low mode.
   d. "High Impedance state" using modified totem pole

.....END.....

PH 121 PHYSICS - II

THIRD QUIZ Date : 08.04.2015 TIME : 09.00 hrs to 10.00 hrs

B.Tech (all branches)

(attempt all questions)

1. Using the magnetic vector potential **A** of an infinite solenoid having n-turns per unit length, radius R and current I, find the magnetic field inside and outside the solenoid and also find divergence of **A**. (05)

2. Find the magnetic dipole moment of the spinning spherical shell (Fig. 1). Using that show, for points $r \geq R$ the magnetic field is that of a perfect dipole. (05)

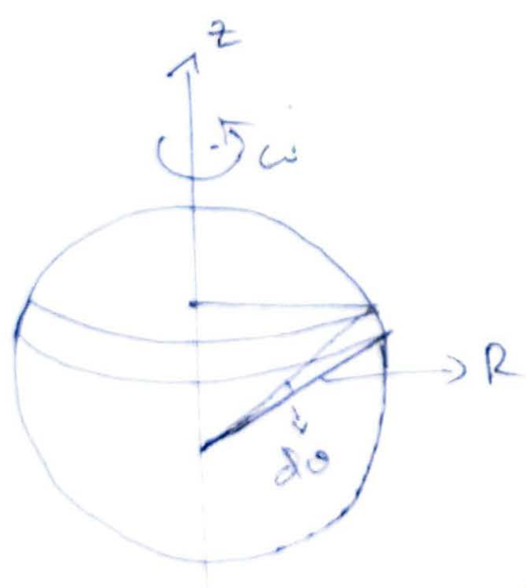
3. A long cylinder of radius R carries a magnetization $\mathbf{M} = \mathbf{k}\rho^2\hat{\phi}$, where k is a constant, ρ is the distance from the axis. Find the magnetic field due to **M**, for points inside and outside the cylinder.(05)

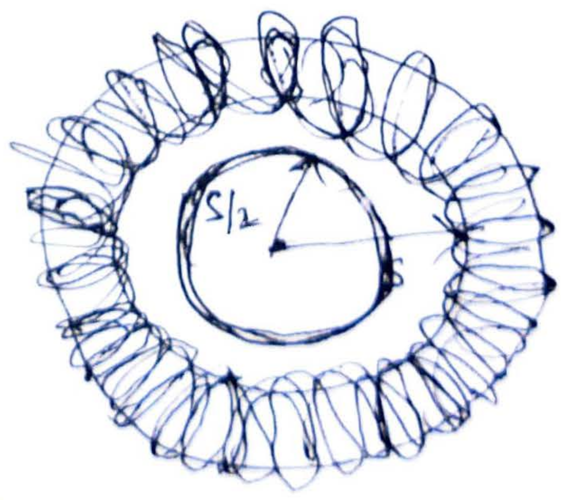
4. A circular toroidal coil(N-turn) is driven by an alternating current $I = I_0 cos\omega t$. Inside the toroidal coil, a circular loop of wire of radius s/2 and resistance R is placed inside co-axial with it(Fig.2). Find the induced current in the loop as a function of time. (05)

$\mu_0 I$

dl

$= \frac{\mu_0 N I}{2\pi R}$





INDIAN INSTITUTE OF SPACE SCIENCE AND TECHNOLOGY
THIRUVANANTHAPURAM 695 547

Quiz III - April 2015

B. Tech - II Semester

MA121 - Vector Calculus and Differential Equations

Date: 09/04/2015 | Time: 9.00 am - 10.00 am | Max. Marks: 15

Attempt all questions

1. (a). Evaluate the following limit with appropriate justification: [2]

$$\lim_{n\to\infty}\int_0^1 \frac{n+e^x}{n+x^2}\,dx.$$

(b). Check whether the function $f(x) = \sum_{n=1}^{\infty}\frac{\cos^n x}{n^3}$ is differentiable on $(-\infty, +\infty)$. Justify your answer. [3]

2. (a) Define directional derivative of a real valued function f defined on a domain $D \subset \mathbb{R}^2$. [1]

(b) Let $f : \mathbb{R}^2 \longrightarrow R$ be given by

$$f(x,y) = \begin{cases} \dfrac{x^2 y}{x^4+y^2} & if\ (x,y) \neq (0,0) \\ 0 & otherwise \end{cases}$$

Suppose $\vec{v} = (v_1, v_2)$ be an vector in $\mathbb{R}^2$ such that $v_1 \neq 0 \neq v_2$. Show that $D_x f|_{(0,0)}$, $D_y f|_{(0,0)}$ and $D_{\vec{v}} f|_{(0,0)}$ exist. Is it possible to express $D_{\vec{v}} f|_{(0,0)}$ in terms of the partial derivatives? Is f is differentiable at $(0,0)$? Justify your answer. [2.5 + 0.5 + 1]

3. For each of following vector fields $\vec{F}$, find a scalar field f, if possible, such that $\nabla f = \vec{F}$ indicating the domain of $\vec{F}$. Justify, if you claim that no such f exists.

(a) $\vec{F}(x,y,z) = (ye^z,\ xe^z,\ xy)$ [2]

$\nabla f = \vec{F}$: $(D_x f, D_y f, D_z f)$

(b) $\vec{F}(x,y,z) = (2x + y\sin z,\ y + x\sin z - \sin y,\ xy\cos z)$ [3]

xye^z

$ye^z + c_1(y,z)$

$f = xye^z +$

$xe^z = e^z + \frac{\partial}{\partial y} c_1(y,z)$

INDIAN INSTITUTE OF SPACE SCIENCE AND TECHNOLOGY

THIRUVANANTHAPURAM

Quiz III – April 6, 2015

CH 121- Materials Science and Metallurgy

Second Semester

Time: 1 h **Max. Marks: 25**

Answer all questions

1. (a) What are pre-ceramic polymers? Give an example.
   (b) What are ferroelectric ceramics? Give an example. Why poling is important in a ferroelectric ceramic? (2+3)

angles

2. (a) The density and lattice parameter of FCC Palladium are 11.98 g/cc and 3.8902 A°, respectively. Calculate the fraction of lattice points that are vacant. The atomic mass of Palladium is 106.4 g/cc.

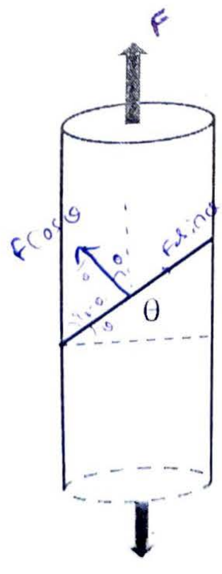
   (b) Why ionic crystals are brittle even though they contain dislocations (3+2)

3. (a) What are ultrahigh temperature ceramics? Give examples and application

   (b) Give two examples to show the defects in crystals are useful (2.5 + 2.5)

4. 916 KDM (trademark) gold has cadmium and/or copper added intentionally to the jewellery. Justify the above statement. (2)
5. Though possessing 48 slip systems, BCC metals are stronger than FCC metals that have only 12 slip systems? Why (2)
6. Solve for the critically resolved shear stress along the slip plane and slip direction. (2)
7. Sketch the distribution of normal and shear stress on a plane oriented at angles of 25, 45, 75, 90, 120, 145, 165, 180 to the normal axis. Superimpose the two curves on the same graph (4)

fracture without permanent deformation



$N \rightarrow 25$ N S.

		N	S
50	25	0.821	0.383
$90 = \frac{\theta}{\cos\theta}$	45	0.5	0.5
150	75	0.066	0.25
180	90	0	0
	120	0.25	-0.433
240	145	0.671	-0.469
290	165	0.933	-0.21
330	~~180~~	1	0
360	180		

0, 45°, 90°, 180

cu Ag, Au