

FOURTH SEMESTER**B.E. (COE/EC/EE)****MID SEMESTER EXAMINATION MARCH****2005****COE/EC/EE-211 ELECTRONICS-II***Time: 1 Hour 30 Minutes**Max. Marks : 20***Note :** Attempt **ALL** questions.

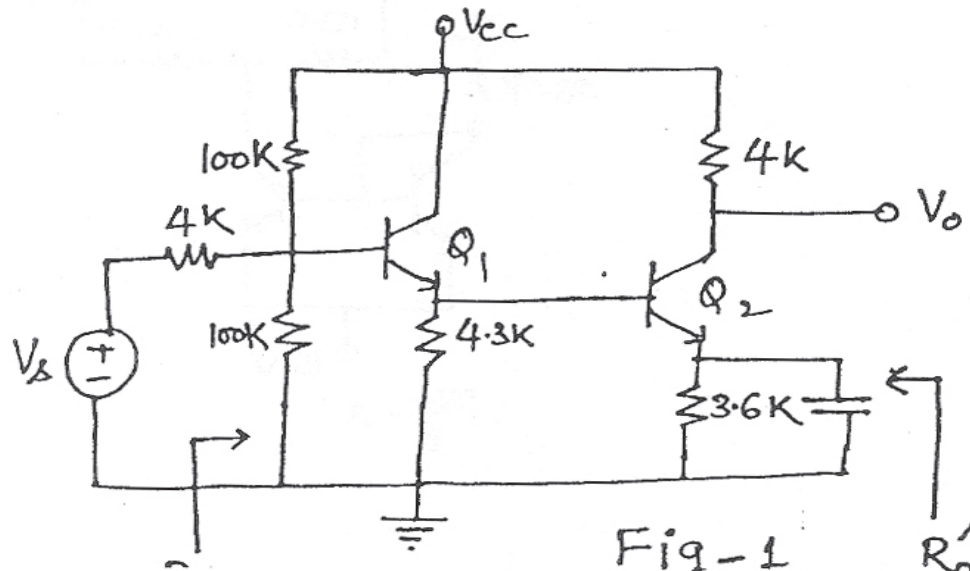
Assume suitable missing data, if any.

- 1[a] Why do we use active loads in amplifiers? 2
- [b] For a common emitter stage use Miller's theorem to determine input and output capacitance. In hybrid π model current through C_{μ} branch may be neglected. 2
- [c] Is the dominant pole approximation valid for the given transfer function 1

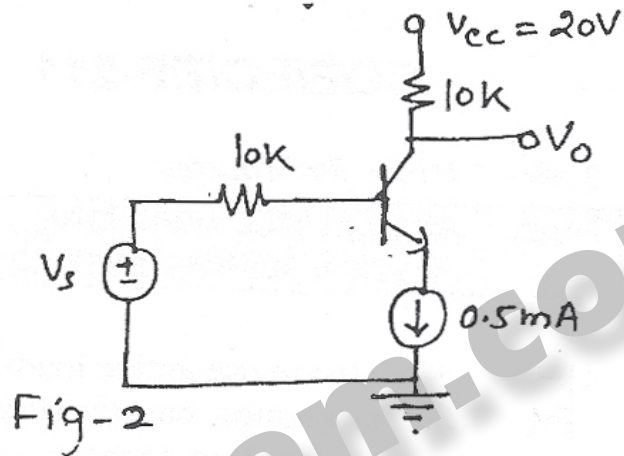
$$A_{V_H} = \frac{A_{V_C} (1 + s/10^{18})}{(1 + s/10^8) (1 + s/10^{16})}$$

if yes, determine ω_H .

2. For the circuit shown in figure-1 determine the overall voltage gain $\frac{V_o}{V_s}$, input impedance and output impedance. Both Q_1 and Q_2 have $\beta_F = 150$ and $r_{\pi} = 2.5 \text{ K}$. 6

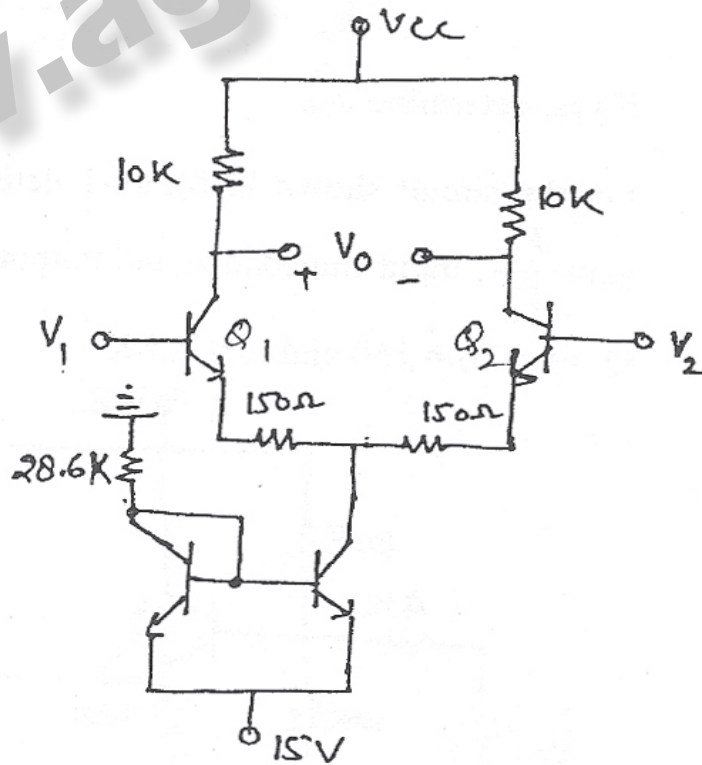


- 3 For a transistor biased at $I_{CQ} = 1\text{mA}$ $\beta_0 = 160$; at $f = 50\text{ MHz}$ $|\beta(j\omega)| = 8$. Determine f_T and f_β . What is the value of C_π if $C_\mu = 1\text{pF}$. 4
- 4 For the circuit shown in Fig.2 $\beta_F = \beta_0 = 100$, $C_\mu = 2\text{pF}$, $f_T = 400\text{ MHz}$. Calculate mid band gain (A_{V_o}) and upper 3dB frequency f_H . 5



OR

For the circuit shown in Fig.3. Find the differential mode gain and common mode gain. Assume $r_\pi = 2\text{K}$ for both Q_1 and Q_2



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FOURTH SEMESTER

B.E. (EE/EC/COE)

MID SEMESTER EXAMINATION MARCH 2005

EE/EC/COE-212 ELECTROMAGNETICS

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Answer ALL questions.
Assume suitable missing data, if any.

- 1 Determine if the vectors $(\hat{a}_r - \sqrt{3}\hat{a}_\phi + 3\hat{a}_z)$ at the point $\left(3, \frac{\pi}{3}, 5\right)$ in cylindrical co-ordinates is equal to the vector $3\hat{a}_r - \sqrt{3}\hat{a}_\theta - \hat{a}_\phi$ at the point $\left(1, \frac{\pi}{3}, \frac{\pi}{6}\right)$ in spherical co-ordinates. (4)

- 2 Verify Gauss's divergence theorem for the vector field $\vec{A} = r^2 \cos^2 \phi \hat{a}_r + z \sin \phi \hat{a}_\phi$ over any closed surface bounded by $r=4, 0 \leq z \leq 1$. (4)

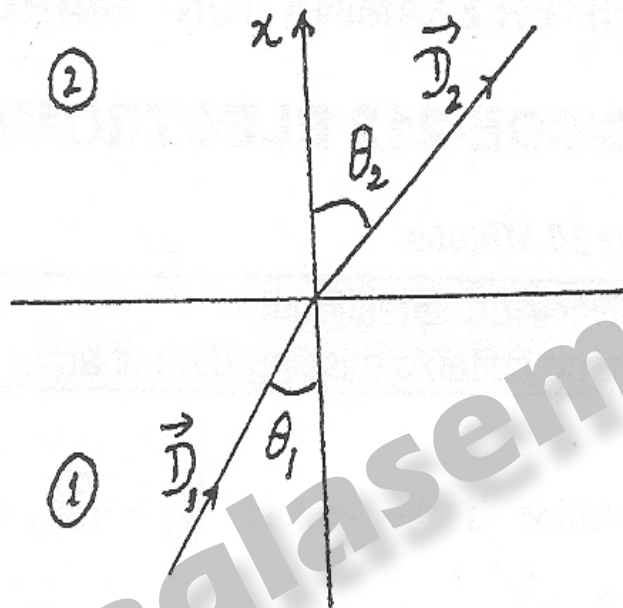
- 3 A potential field is expressed by

$$V = \frac{50r^2 \cos \phi}{(z+1)} \text{ (V)}.$$

Given a point A (4m, 30° , 2m) in free space. Calculate:

- [a] Potential at point A,
- [b] Electric field intensity at A,
- [c] Volume charge density at A and
- [d] Unit vector in the direction of potential gradient. (4)

- 4 A homogeneous dielectric $\epsilon_r = 2.5$ fills region 1 ($x \leq 0$), while region 2 ($x \geq 0$) is free space.
- [a] If $\vec{D}_1 = 12\hat{a}_x - 10\hat{a}_y + 4\hat{a}_z$ nC/m², find \vec{D}_2 and θ_2 .
- [b] If $E_2 = 12$ Vm⁻¹ and $\theta_2 = 60^\circ$, find E_1 and θ_1 . (4)



- 5 A point charge Q is placed at a distance ' d ' from the centre of a grounded conducting sphere of radius a ($a < d$). Applying the method of images, determine (a) the charge distribution induced on the surface of the sphere, and (b) the total charge induced on the sphere. (4)

FOURTH SEMESTER**B.E. (EE)****MID SEMESTER EXAMINATION MARCH 2005****EE-213 MATHEMATICS-IV**

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Answer **ALL** questions.
Selecting **TWO** parts from each question.
Assume suitable missing data, if any.

- 1[a] For what values of z the function w defined by the following equation ceases to be analytic,
$$Z = e^{-v}(\cos u + i \sin u)$$
- [b] Determine the points in z -plane where the mapping $w = Z + \frac{1}{Z}$ fails to be conformal. Also discuss the transformation. Find the image of unit circle in z -plane in w -plane.
- [c] If $f(z)$ is analytic in region R . A and B are any two points in the region. Prove that $\int_A^B f(z)dz$ is independent of path.
- (6)

2[a] Use Cauchy's integral formula to evaluate $\int_C \frac{e^{2z}}{(Z+1)^4} dz$ if

- (i) C is the circle $|Z| = 2$ (ii) C is $|Z| = \frac{1}{2}$

[b] Find the poles and their order of the following function

- (i) $\frac{1}{z^4 + 1}$ (ii) $\frac{1 - e^{2z}}{z^4}$ (iii) $e^{\frac{1}{z^2}}$

- [c] Evaluate $\int \frac{z-1}{(z+1)^2(z-2)} dz$ where c is $|z-i|=2$, where clockwise direction being taken as positive.

(7)

3 Evaluate the following integral by contour integration

[a] $\int_0^\pi \frac{\cos 3\theta}{5-4\cos\theta} d\theta$

[b] $\int_a^\infty \frac{\cos x}{(x^2+a^2)(x^2+b^2)} dx \quad a > b > 0$

[c] $\int \frac{\sin x}{x} dx$

(7)

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FOURTH SEMESTER

B.E. (EE)

MID SEMESTER EXAMINATION **MARCH 2005**

EE-214 FLUID MECHANICS AND HYDRAULIC MACHINES

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Question No. 1 is compulsory
Answer any other **TWO** questions from the remaining.
Assume suitable missing data, if any.

- 1[a] Define and explain the terms :
- (i) Newtons law of viscosity
 - (ii) Centre of Pressure
 - (iii) Reynold's Number
 - (iv) Mach Number
- [b] Distinguish between
- (i) Laminar and turbulent flow
 - (ii) Steady and unsteady flow
 - (iii) Uniform and Non Uniform flow
- [c] An oil of viscosity 4 poise is used for lubrication between a shaft and sleeve. The diameter of the shaft is 500 mm and it rotates at 200 r.p.m. Calculate the power lost in the oil for a sleeve length of 100 mm. The thickness of the oil film is 1.0 mm.
- (2+2+2)
- 2[a] State Burnoulli's theorem and the assumptions made in it's derivation.
- [b] A venturimeter of inlet diameter 300 mm and throat diameter 150 mm is inserted in a vertical pipe carrying water. The flow of water is in the upward direction. A differential mercury-manometer connected at the inlet and the throat shows a reading of 300 mm. Find the discharge. Take the value of $C_d = 0.98$.

[c] A circular plate of diameter 3 m is immersed in water in such a way that its least and greatest depth from the free surface of water are 1 m and 3 m respectively. For the front side of the plate, find (i) total force exerted by water and (ii) the position of centre of pressure. (2+2+3)

3[a] The force exerted by a flowing fluid on a stationary solid body depends upon the length of the body L , velocity of flow V , density of fluid ρ , viscosity of fluid μ and acceleration due to gravity g . Find the expression for the force using dimensional analysis.

[b] A liquid of viscosity 5 poise and specific gravity 0.9 is flowing through a circular pipe of diameter 100 mm. The maximum velocity at the centre of the pipe is 2 m/s. Find (i) Pressure gradient in the direction of flow (ii) Maximum shear stress on the surface of pipe (iii) Reynold's Number of the flow. (iv) Velocity of the liquid at a point which is 10 mm away from the surface of pipe. (3+4)

4[a] Define and explain the terms : Major and Minor losses in the pipe, Hydraulic gradient line and Total energy line and equivalent pipe.

[b] The rate of flow of water through a horizontal pipe is 300 l/s. The diameter of the pipe which is 200 mm is suddenly enlarged to 400 mm. The pressure intensity in the smaller pipe is 12 N/cm^2 . Find (i) loss of head due to sudden enlargement (ii) Pressure intensity in the large pipe (iii) Power loss due to enlargement.

[c] What is the function of pitot tube? Draw it's neat sketch.

(3+3+1)

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FOURTH SEMESTER

B.E. (EE)

MID SEMESTER EXAMINATION **MARCH** 2005

EE-215 APPLIED THERMODYNAMICS

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Attempt ALL questions.

For Air C_p 1.005 KJ/kg-K, $\gamma = 1.4$.

Assume missing data suitably, if any.

1[a] A heat pump operating on reversed carnot cycle takes in energy from a reservoir maintained at 3°C and delivers it to another reservoir maintained at 77°C . The heat pump derives power for its operations from a reversible engine operating within the higher and lower temperature limits of 1077°C and 77°C . Estimate the energy taken from the reservoir at 1077°C for 100 KJ/s of energy supplied to the reservoir at 77°C .

[b] What do you mean by throttling process? 5+2

2[a] Air at 1 bar, 20°C is taken into gas turbine power plant at a velocity of 120 m/s through an opening of 0.15 m^2 cross sectional area. The air is compressed in a compressor, heated in a combustion chamber, expanded through turbine and exhausted at 1.2 bar, 300°C through an opening of 0.1 m^2 . The power output is 1MW. Calculate the net amount of heat added to the air in kW/kg.

[b] A thermodynamic system has a heat capacity at constant volume expressed as $C_v = AT^2$ where $a = 0.043 \text{ J/K}^2$. The system is originally at 27°C . A low temperature thermal reservoir at -73°C is available so that a heat engine can be operated. Calculate the maximum amount of work that can be obtained as

the system is cooled down to the temperature of the reservoir.

3+4

- 3[a] A control mass undergoes a reversible three process cycle. The working substance is air. The initial pressure and temperature are 0.1 MPa and 300 K. Air is first compressed isothermally to 0.6 MPa. It is then heated at constant pressure. Finally, it is brought to the initial state by an adiabatic expansion process. Evaluate heat transfer and work transfer for each process. Verify that cyclic integral of heat is equal to cyclic integral of work for this cycle. Draw the cycle on p-v and T-S diagram.
- [b] Define the term absolute zero of temperature and show how a scale of temperature can be derived from operation of reversible heat engine.

4+2