

NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR
Department of Earth and Environmental Studies
Odd Semester Mid-Term Examination, 2023-24

Course Code: ESC331

Course Name: Geology for Civil Engineering

Full Marks: 25

Time: 90 Minutes

Instructions: Answer any five of the following questions:

Question No.	Body of the Question	Marks
1	(a) Name the four most dominant elements present in the rocks of earth's crust. (b) Define mineral and name three most dominant minerals present in the rocks of earth's crust.	2+3=5
2	(a) Define ore mineral. Name two ore minerals and also mention the metals which would be extracted from those. (b) What is the streak of the following four minerals – calcite, galena, haematite and magnetite?	3+2=5
3	(a) Define magma. (b) Name three basic types of magma and also mention their differences in chemical composition. (c) Define magma viscosity.	1+3+1=5
4	(a) Define igneous rock. (b) Write a brief note on types of igneous rock based on the mode of occurrence. Give an example of one rock from each type.	1+4=5
5	Write a note on common structures seen in igneous rock.	5
6	Define sedimentary texture and also discuss the factors which determine the sedimentary texture.	5
7	(a) Define metamorphism. (b) Write a short note on factors or agents of metamorphism.	1+4=5

NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR**Department of Earth and Environmental Studies****Odd Semester Mid-Term Examination, 2023-24****Course Code:** ESC332**Course Name:** Economic Geology

Full Marks: 25

Time: 90 Minutes

Instructions: All the questions are compulsory:

Question No.	Body of the Question	Marks
1	(a) Describe Prograde and retrograde metamorphism (with diagram) (b) What is the streak of the following three minerals – calcite, haematite, and magnetite?	3+2=5
2	Describe the chemical-based (on the basis of Alumina: Al_2O_3) classification of Igneous rocks.	5
3	(a) Define texture. (b) Describe different types of igneous textures.	1+4=5
4	(a) Define metamorphism. (b) Explain Bowen's Reaction Series (with diagram)	1+4=5
5	With suitable diagrams, write a short note on Metamorphic grade, and Metamorphic Facies	3+2=5

NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR**Odd Semester Mid-term Examination, 2023-24****Course Code: ECE712**

Full Marks: 25

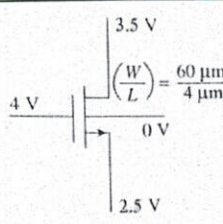
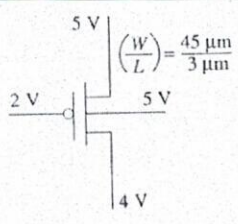
Course Name: Analog IC Design

Time: 90 mins(1.5Hours)

Question Paper No.: Roll No:

Date of Exam:

Instructions: Answer all the questions.

Note:	Following parameters are to be used unless otherwise stated. $\mu_n C_{OX} = 2\mu_p C_{OX} = 50 \mu A/V^2$ and $V_{TN} = -V_{TP} = 1 V$, $\lambda_N = \lambda_P = (0.1/L)^{-1}$; L in μm , $\gamma_N = \gamma_P = 0.6 V^{1/2}$, $\Phi_N = -\Phi_P = 0.42 V$. All symbols carry their usual meaning.		
Question No.	Body of the Question	Marks	Mapped CO
1.	a) What are the different processes available in CMOS IC design? Draw the structural view of NMOS and PMOS transistors in the most standard process. b) Briefly discuss the following terms: STI, Silicide, Self-gain, and transit frequency (f_T).	5+5	CO1
2.	a) Draw and explain the IV characteristics of an NMOS transistor with necessary equations. What is sub-threshold slope factor (m) and how it is calculated? b) Derive the expressions of g_m in terms of device/bias parameters when MOSFET is in saturation.	5+5	CO2
3.	a) What is the importance of current mirror in Analog IC design? Draw the schematic of Cascode current mirror stating its advantages, disadvantages. OR b) Determine the drain current and operating region of the MOSFETs shown.	5	CO3
	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Fig. 3b(i)</p> </div> <div style="text-align: center;">  <p>Fig. 3b(ii)</p> </div> </div>		

Course Outcomes

CO1: Describe the operation of a MOS transistor /Amplifier/other fundamental blocks.

CO2: Solve any given circuit using appropriate Large/Small Signal model equations.

CO3: Evaluate various performance metrics such as gain/BW/Power dissipation/Input & output range.

CO4: Analyze feedback circuit and determine its poles, zeros, gain margin & phase margin.

CO5: Design a Single stage Amplifier/Differential Amplifier to meet the given specifications.

NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR**Odd Semester Mid-Term Examination, 2023-24**

Course Code: ECE722


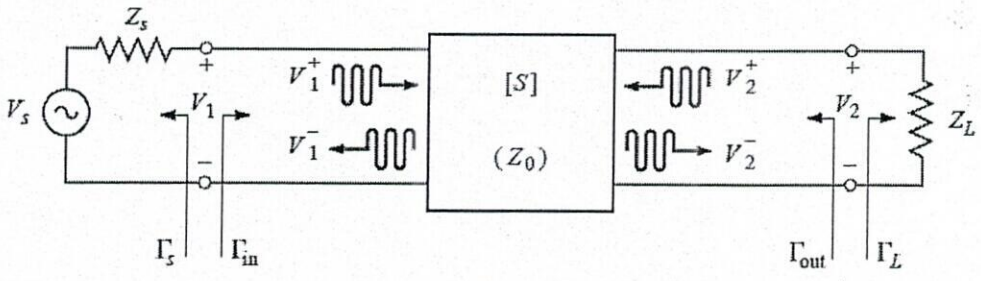
Full Marks: 25

Course Name: Microwave Circuits and Techniques

Time: 90 Minutes

Instructions: Answer all the questions.

Materials to be supplied: Graph paper shall be supplied, if required.

Question No.	Body of the Question	Marks	Mapped CO
1	<p>(a) Discuss the properties of scattering matrix.</p> <p>(b) A two port microwave network has scattering matrix as shown below.</p> $\begin{bmatrix} 0.1\angle 0^\circ & 0.8\angle 90^\circ \\ 0.8\angle 90^\circ & 0.2\angle 0^\circ \end{bmatrix}$ <p>(i) Is the network lossless? (ii) Is the network reciprocal? (iii) What is the return loss at port 1 if a short circuit is placed at port 2?</p>	2+3	CO1
2	<p>Deduce the expression for input impedance of a transmission line as seen from the generator end illustrated in figure below:</p> 	5	CO2
3	<p>(a) Consider a coaxial cable, with inner and outer conductor diameters of 0.0645 in. and 0.215 in., and a Teflon dielectric with $\epsilon_r = 2.2$. What is the highest usable frequency before the TE_{11} waveguide mode starts to propagate? Consider a 5% safety margin.</p> <p>(b) What is a Smith chart and how it is useful to microwave engineers?</p>	3+2	CO1
4	Classify microwave power measurement. Explain the basic principle of operation of a bolometer.	5	CO3
5	<p>Consider a schematic of a two-port network.</p>  <p>Deduce an expression for the power gain $G = P_L/P_{in}$</p>	5	CO2

Course Outcomes**CO#1** Students will be able to learn the intricacies of design constraints at high frequency.**CO#2** The students can design and synthesize planar circuits and can provide reasoning for the obtained results.**CO#3** The basic training for understanding planar passive circuit design at microwave frequencies for defense and space applications would be enriched.

NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR
Odd Semester Mid-Term Examination, 2023-24

Course Code: ECE724

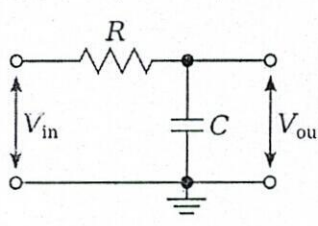
Full Marks: 25

Course Name: Biomedical Instrumentation

Time: 90 Minutes

Instructions: Answer all the questions.

Materials to be supplied: Graph paper shall be supplied, if required.

Question No.	Body of the Question	Marks	Mapped CO
1	<p>Short note:</p> <p>a. Mention and discuss two different applications of biomedical instruments</p> <p>b. Hence, illustrate both the applications using proper functional blocks.</p>	5	CO1
2	Define transfer function for a generic system in s domain. Write the restrictions in the formulation of transfer function. Can any Laplace equation be expressed by transfer function? Justify.	5	CO2
3	Explain with algebraic expressions, why do we require a linear time-invariant first order ODE to model the dynamical response of a conventional clinical thermometer? -	5	CO2
4	<p>Suppose a physical system is modeled as a first order RC circuit. Calculate the half power bandwidth of the following system. $R = 100 \text{ Ohm}$, $C = 50 \text{ pF}$.</p> 	5	CO3
5	Mention and discuss any three types of temperature sensors. Hence, explain with proper justification which temperature sensor among those is most suitable for designing a clinical thermometer.	5	CO4

Course Outcomes

- CO 1: Understand concept of Biomedical Instrumentation
- CO 2: Understand basic building blocks of Biomedical Instruments
- CO 3: Apply quantitative analysis techniques to Biomedical Instruments
- CO 4: Learn design techniques of Biomedical Instruments
- CO 5: Investigate application specific Biomedical Instruments