Autonomous Programme Structure of Second Year B. Tech. AY 2019-2020

S. Y. B. Tech. Electronics & Telecommunication Engineering Semester – II										
Course Code	Course Title	Teaching Scheme			Examination Scheme				Marks	Credit
		Hours/Week								
		Lecture	Tutorial	Practical	In Semester	End Semester	Oral	Practical		
EC 2201	Signals & Systems	3	1	0	50	50	0	0	100	4
EC 2202	Analog Communication	3	1	0	50	50	0	0	100	4
EC 2203	Integrated Circuits and Applications	3	1	0	50	50	0	0	100	4
EC 2204	Object Oriented Programming	3	0	0	50	50	0	0	100	3
HS 2201	Principles of Economics and Finance	3	0	0	50	50	0	0	100	3
EC 2205	Analog Communication Lab	0	0	2	0	0	0	25	25	1
EC 2206	Integrated Circuits and Applications Lab	0	0	2	25	0	0	0	25	1
EC 2207	Object Oriented Programming Lab	0	0	4	0	0	25	0	25	2
AC 2201	Self Expression	0	0	2	0	0	0	0	0	No credit
	Total	**15**	**3**	**10**	**275**	**250**	**25**	**25**	**575**	**22**
	Grand Total	**28**							**575**	**22**

EC 2201 Signals and Systems

Teaching Scheme:
Lectures: 3 Hrs/Week
Tutorial: 1 Hr/Week

Examination Scheme:
In-Semester: 50 Marks
End-Semester: 50 Marks
Credits: 4

Course Objectives:

1. Introduce basic signals and operations on signals
2. Learn systems, types and their analysis
3. Introduce the concept of Fourier transform and its applications
4. Make students familiar with the concept of correlation and spectral density
5. Introduce the concepts of Probability theory, distribution and density functions and statistical averages

Course Outcomes:

Having successfully completed this course, the student will be able to:

1. Classify signals and perform operations on signals
2. Analyse a system and identify its type
3. Resolve the signals in frequency domain and plot the spectrum
4. Apply the concepts of correlation and spectral density for different applications
5. Evaluate PDF, CDF and the statistical parameters

Unit 1: Introduction to Signals **(10)**

Definition of signals and systems, conversion of analog signal to digital signal. Classification of signals: Continuous Time (CT) and Discrete Time (DT), Even, Odd, Periodic and Non-periodic, Deterministic and Non-deterministic, Energy and Power. Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration, time scaling, time shifting and folding, precedence rule. Elementary signals: Exponential, Sine, Step, Impulse and its properties, Ramp, Rectangular, Triangular, Signum, Sinc.

Unit 2: Systems and their analysis **(10)**

Systems: Definition, Classification: linear and non-linear, time-variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible. System modelling: Input-output relation, impulse response, Definition of impulse response, convolution integral, convolution sum, Computation of convolution integral using graphical method, Computation of convolution sum. Properties of convolution, system interconnection, system properties in terms of impulse response, step response in terms of impulse response.

Unit 3: System Analysis using Fourier analysis **(08)**

Definition and necessity of CT and DT Fourier Series and Fourier Transform (FT). Orthogonality concept, Magnitude and phase spectrum, CT Exponential Fourier series (FS), CT Fourier Transform and its properties, problem solving using properties, Interplay between time and frequency domain, Inverse Fourier transform.

Unit 4: Correlation and Spectral Density **(08)**

Definition of Correlation and Spectral Density, Correllogram, analogy between correlation and convolution, Auto-correlation and Cross-correlation for CT and DT signals, Energy / Power spectral density of CT signals, properties of correlation and spectral density, inter-relation between correlation and spectral density, Applications of correlation and spectral density.

Unit 5: Probability and Random Variables **(06)**

Sample space, Event, Probability, Conditional probability and statistical independence, Random Variables: Discrete Random Variables, Cumulative Distributive Function, Continuous Random Variable, Probability Density Function, Properties of CDF and PDF, Statistical averages, Mean, Moments and exceptions, Standard Deviation and variance, Probability models: Uniform, Gaussian, Rayleigh, Binomial, Poisson.

Text books:

1. Simon Haykins and Barry Van Veen, '**Signals and Systems'**, *Wiley India,* (2nd Edition),(2004).
2. Simon Haykins, '**An Introduction to Analog and Digital Communications**', *Wiley India,* (2nd Edition), (2008).

Reference Books:

1. Charles Phillips, '**Signals, Systems and Transforms'**, *Pearson Education,* (4th Edition), (2004).
2. Lathi B. P., '**Signals, Systems and Communication**', *BS Publication,* (1st Edition), (2009).
3. Mrinal Mandal and Amir Asif, '**Continuous and Discrete Time Signals and Systems**', *Cambridge University Press,* (1st Edition), (2007).
4. Peyton Z. Peebles, Jr., "Probability, Random Variables and Random Signal Principles", (4th Edition), (2013).

Website:

1. https://nptel.ac.in/courses/117101055/

List of Tutorials:

3. Classification of the signals as Even/Odd, Periodic / Non-Periodic and Energy / Power.
4. To perform operations like amplitude scaling, addition, multiplication, time scaling, time shifting and folding on CT and DT signals.
5. Apply system analysis to determine whether the given system is, memory less, causal, linear, stable, time invariant, invertible.
6. Perform convolution operation on continuous time and discrete time signals.
7. Apply the concept of Fourier Series on time domain signals.
8. Evaluate ESD and PSD of CT signals.
9. Apply concepts of CDF, PDF and Statistical averages.
10. MATLAB/C assignment on signal operations

seely discriminator, ratio detector

Unit 5: Noise **(06)**

Sources of Noise, Types of Noise, White Noise, Thermal noise, shot noise, partition noise, Low frequency or flicker noise, burst noise, avalanche noise, Signal to Noise Ratio, SNR of tandem connection, Noise Figure, Noise Temperature, Friss's formula for Noise Figure, Noise Bandwidth. Behaviour of base band systems, DSBSC, SSBSC and AM in the presence of noise

Unit 6: Pulse Analog modulation **(06)**

Multiplexing- FDM,TDM, Band limited and time limited signals, Narrowband signals and systems, Sampling theorem in time domain, Nyquist criteria, Types of sampling- ideal, natural, flat top, Aliasing and Aperture effect. Block diagram approach of PAM, PWM and PPM

Text Books:

1. B. P. Lathi, '**Modern Digital and Analog Communication Systems**', *Oxford University Press,* (3^{rd} Edition) ,(2003).
2. George Kennedy, '**Electronic Communication Systems**', *McGraw-Hill,* (5^{th} Edition), (2013).

Reference Books:

1. Dennis Roddy and Coolen, '**Electronic Communication**', *Prentice Hall,* (4^{th} Edition), (2011).
2. R.P.Singh and S.D.Sapre, '**Communication Systems**', *McGraw-Hill. (*3^{rd} Edition), (2016).
3. Blake R.,'**Electronic Communication Systems**', *Thomson Publication,* (2^{nd} Edition), (2002).
4. Simon Haykin, '**Communication Systems**', *John Wiley and Sons,(* 4^{th} Edition), (2000).
5. Taub and Schilling, '**Principles of Communication Systems**', *Tata McGraw-Hill,* (3^{rd} Edition) (2012).
6. Frenzel, '**Principles of Electronic Communication Systems**', *Tata McGraw-Hill,* (3^{rd} Edition), (2008).

Website:

6. https://onlinecourses.nptel.ac.in/noc17_ec11/preview

List of Tutorials:

9. Calculation of signal bandwidth, spectrum components and modulation index.
10. Calculation of power relationships in AM, Transmission efficiency of different modulation techniques.
11. Analysis of power saving in DSB-SC, SSB-SC systems.
12. Calculation of intermediate frequency, image frequency and IFRR in AM/FM receiver system.
13. Design of super heterodyne radio receiver system.
14. Calculation of modulation index, deviation ratio in FM, PM.
15. Calculation of noise power, SNR, Noise figure.
16. Analyse behaviour of AM, DSB, SSB in the presence of noise.
17. Calculation of nyquist rate, sampling frequency in Pulse Modulation system.

EC 2202 Analog Communication

Teaching Scheme:
Lectures: 3 Hrs/Week
Tutorial: 1 Hr/Week

Examination Scheme:
In-Semester: 50 Marks
End-Semester: 50 Marks
Credits: 4

Course objectives:

2. Explain concepts of amplitude modulation and demodulation
3. Explain concepts of angle modulation and demodulation
4. Calculate the frequency and sketch waveform at stages of superheterodyne radio receiver
5. Compare types of noise and their effect on communication system
6. Explain Pulse Analog Modulation technique

Course Outcomes:
Student will be able to-

6. Identify need for modulation and explain basic concept of amplitude modulation and demodulation
7. Explain the basic concepts of Angle Modulation and demodulation
8. Calculate signal to noise ratio, noise figure and noise temperature of single and cascaded stages in communication system
9. Design of tuning circuits in AM Receiver
10. Design FM radio receiver system at block diagram level
11. Explain the concept of pulse amplitude modulation

Unit 1: Amplitude (Linear) Modulation **(08)**

Block diagram of basic communication system, Base band and Carrier communication, Need for modulation, Generation of AM (DSBFC) and its spectrum, Power relations applied to sinusoidal signals, Types of AM: DSBSC – multiplier modulator, Non linear generation, Switching Modulator, Ring modulator and its spectrum, Modulation Index. SSBSC, ISB and VSB, their generation methods and Comparison, AM Broadcast technical standards.

Unit 2 : AM Receiver **(08)**

Block diagram of AM Superheterodyne Receiver, Performance Characteristics: Sensitivity, Selectivity, Fidelity, Image Frequency Rejection, Tracking. AM Demodulation: Rectifier detection, Envelope detection. DSB & SSB Detector

Unit 3: Angle Modulation **(08)**

Instantaneous frequency, Concept of Angle modulation, frequency spectrum, Narrow band and wide band FM, Modulation index, Bandwidth, Phase Modulation, Bessel's Function , Generation of FM (Direct and Indirect Method), Comparison of FM and PM, FM Demodulation.

Unit 4: FM Receiver **(06)**

Block diagram of FM Super heterodyne Receiver, Pre-emphasis and De-emphasis. FM stereo receiver, FM Detection using PLL, FM detector: Slope detector, balanced slope detector, Foster-

EC 2203 Integrated Circuits and Applications

Teaching Scheme:
Lectures: 3 Hrs/Week
Tutorial: 1 Hr/Week

Examination Scheme:
In-Semester: 50 Marks
End-Semester: 50 Marks
Credits: 4

Course Objectives:

3. Introduce the working principle of Op-Amp
4. Discuss characteristics of Op-Amp and explain practical limitations
5. Familiarize the students with linear and non-linear applications of Op-Amp
6. Introduce signal converters (A/D, D/A)
7. Explain the characterstics of active filters, oscillators and operating principles of PLL

Course Outcomes:

Having successfully completed this course, the student will be able to:

3. Explain the significance of internal stages to determine the performance of general purpose Op-Amp
4. Interpret and calculate performance parameters of Op Amp
5. Design and analyze linear and non linear applications of Op Amp
6. Explain the operation and charecteristics of A/D and D/A converters and phase lock loop
7. Calculate performance parameters of A/D and D/A converters and phase lock loop
8. Design Op Amp based butterworth filters

Unit 1: OP-AMP Basics **(07)**

Block diagram of OP-Amp and significance of each block, Differential Amplifier configurations, Differential amplifier analysis for dual-input balanced-output configuration, Methods for improving CMRR of Differential Amplifier, Need of level shifter, Output stage of Op-amp.

Unit 2 : OP-AMP Performance Parameters **(06)**

Symbol and ideal equivalent circuit of OP-Amp, DC characteristics: Offset Voltage, Bias current, Offset current, Thermal drift, AC characteristics: Slew rate, Rise Time, CMRR, Frequency characteristics. Ideal parameters and practical parameters of OP-AMP and their comparison, Frequency compensation.

Unit 3 : Linear Applications of OP-AMP **(08)**

Inverting and Non-inverting amplifier, Voltage follower, Summing amplifier, Difference Amplifier, Instrumentation Amplifiers, Instrumentation Amplifier Applications. Ideal integrator, errors in ideal integrator, practical integrator, design of practical integrator, Ideal differentiator, errors in ideal differentiator, practical differentiator.

Unit 4 : Non-linear Applications of OP-AMP **(08)**

Comparator, Characteristics of comparator, Applications of comparator, Schmitt trigger, Square wave generator, Triangular wave generator, Need of precision rectifier, Half wave and Full wave precision rectifiers.

Unit 5 : Signal Converters **(06)**

I to V and V to I converter, DAC: Characteristics, Specifications and Types, ADC: Characteristics,

Specifications and Types.

Unit 6 : Active filters and PLL **(07)**

First order and second order Active LP Butterworth filter, Filter design and frequency scaling, Block diagram of PLL and its function, Applications of PLL.

Text books:

5. Ramakant A. Gaikwad, **'Op Amps and Linear Integrated Circuits'**, *Prentice Hall,* (4th Edition), (2000).
6. George Clayton and Steve Winder, **'Operational Amplifiers'**, *Newnes Publication,* (4th Edition), (2004).
7. Salivahanan and Kanchanabhaskaran, **'Linear Integrated Circuits'**, *McGraw Hill Education,* (1st Edition), (2013).

Reference Books:

3. Sergio Franco, 'Design with Operational Amplifiers and Analog Integrated Circuits', *McGraw Hill Education,* (3rd Edition), *(2002).*
4. **Texas Instruments Op-amp Book – Op-Amp for Everyone**: Design Reference.
   Sedra Smith, **'Microelectronic Circuits'**, *Oxford Publications,* (5th Edition), *(2004).*
5. **Texas Instruments Op-amp Book – Op-Amp for Everyone**: Design Reference.
6. Sedra Smith, **'Microelectronic Circuits'**, *Oxford Publications,* (5th Edition), *(2004).*
7. D. Roy Choudhury and S. B. Jain, **'Linear Integrated Circuits'**, *New age International publishers,* (2nd Edition), (2003).

Websites:

1. www.ti.com
2. www.nptel.ac.in

List of Tutorials:

6. Analyse differential amplifier circuits.
7. Calculate Op Amp Parameter.
8. Op-amp datasheet- Pin packages, Manufacturers, Technical specifications.
9. Design of integrator and differentiator.
10. Design of instrumentation amplifier.
11. Analyse an application based on Op - Amp.
12. Design of waveform generator.
13. Analyse phase-locked loop (PLL).

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EC 2204 Object Oriented Programming

Teaching Scheme
Lecture: 3 Hours/Week

Examination Scheme
In Semester: 50Marks
End Semester: 50Marks
Credits: 3

Course Objectives:

6. Make the students familiar with the basic concepts and techniques of OOP paradigm
7. Understand C++ and Java as programming languages
8. Develop ability to program in C++ and Java

Course Outcomes:
After completion of course, students will be able to:

8. Explain the principles of Object Oriented Programming
9. Apply the concepts of data encapsulation, inheritance and polymorphism in C++
10. Identify the basic program constructs in Java
11. Apply the concepts of multi-threading, inheritance, interface, exception handling and applets in Java

Unit 1: Introduction to Object Oriented Programming **(07)**
Principles of Object-Oriented Programming, Beginning with C++, Tokens, Expressions and Control Structures, Functions in C++.

Unit 2: Concepts of Object Oriented Programming with C++ **(07)**

Classes and Objects, Constructors and Destructors. Operator overloading, Inheritance and their types. Virtual functions and polymorphism

Unit 3: Java Fundamentals **(07)**

Java Evolution, Overview of Java Language, Constants, Variables, and Data Types, Operators and Expressions, Decision making.

Unit 4: Classes Methods and Objects in Java **(07)**
Classes, Objects and Methods, Arrays and Strings. Overloading methods, Recursion

Unit 5: Inheritance, packages and Interfaces **(07)**
Inheritance basics, constructors in derived class. Object class. Packages, access protection, importing packages. Interfaces: Defining interfaces, Extending interfaces, Implementing interfaces, Accessing interface variables.

Unit 6: Multithreading, exception handling and Applets **(07)**
Introduction to multithreading: Introduction, creating thread and extending thread class. Concept of Exception handling, types of errors, multiple catch statements. Applets: Concept, difference between applets and applications. Life cycle of an applet, types of applets.

Text Books:

4. E Balagurusamy, 'Object Oriented Programming with C++ and Java', McGraw Hill Education (India) Pvt. Ltd., First Reprint 2013.
5. Herbert Schildt, Java: The Complete Reference, McGraw Hill, (7th Edition), (2007).

Reference books:

5. Robert Lafore, **"Object Oriented Programming using C++"**, *SAMS publishing*, (4th Edition),(2002).
6. E Balagurusamy, **"Programming with Java A Primer"**, *Tata McGraw Hill*, (3rd Edition), First Reprint 2007.

Website:

4. http://onlinecourses.nptel.ac.in/noc16-cs19.
2. nptel.ac.in/courses/106105153.

HS 2201-Principles of Economics and Finance

Teaching Scheme:
Lectures: 3 Hrs/Week
Tutorial: Nil

Examination Scheme:
In-Semester: **50** Marks
End-Semester: **50** Marks
Credits: 3

Course Objectives:

5. Enable students to acquire knowledge and develop an understanding of basic concepts and principles of Economics & Finance
6. Make students acquaint with standard concepts and tools that they are likely to find useful in their profession when employed in the firm/industry/corporation in public or private sector
7. Sensitize students to the current economic issues of the nation
8. Develop an understanding of the role of institutions in the functioning of an economy
9. Enhance financial literacy of engineering students

Course Outcomes: Students will be able to :

13. Use the concept of Production Possibility Frontier curve to solve the the questions of What, How and for Whom for economics entities
14. Solve, with the help of Supply and Demand curves, the Equilibrium Price and Quantity for a product or service in various types of market structures
15. Analyze the performance of different business organizations using various ratios (profitability,liquidity and activity) and Break-even Analysis
16. Apply the Time Value of Money to evaluate various investment options available to individuals and firms
17. Examine current Fiscal and Monetary policies by understanding the objectives of Macro Economics
18. Apply knowledge of Economics and Finance to make personal financial decisions

Unit 1: Central Concepts Of Economics **(6hrs)**

Economics as a science of choice and scarcity, Microeconomics and Macroeconomics, Positive and Normative Economics, Basic Economic Problems, Economic Systems-Market, Command and Mixed Economies, Society's Technological Possibilities, Opportunity Cost, Efficiency.

Unit 2: Basic Elements of Supply and Demand **(6hrs)**

Concept of Demand- Demand Schedule and Curve, Law of Demand, Determinants of Demand, Concept of Supply- Supply schedule, Supply curve, Equilibrium of Supply and Demand, Market and Market Structures- Perfect Competition, Monopolistic Competition, Oligopoly, Duopoly and Monopoly.

Unit 3: Role and Environment of Managerial Finance **(6hrs)**

Role of Finance in business, Forms of business organizations, Goals of the firm, Capital structure-Debt and equity capital, Sources of finance, Time value of money, Risk and Return.

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Unit 4: Economic Analysis and Costs **(6hrs)**

Cost Concepts- Fixed and Variable Cost, Marginal Cost, Average Cost, Total Cost, Opportunity Cost, Link between production and cost, Break even Analysis, Financial analysis of a business firm- Statement of Profit and Loss, Balance Sheet, Basic Ratios.

Unit 5: Overview of Macroeconomics **(6hrs)**

Tools to measure economic activity- GDP, Employment rate, Inflation & Consumer Price Index, Fiscal and Monetary policy.

Unit 6: Money and The Financial System **(6hrs)**

Evolution of money, Role and Functions of the Financial System, Indian Financial System, Personal financial strategies.

Text Books:

14. Paul A Samuelson, '**Economics**', Indian Adaptation, Sudip Chaudhari,Anindya Sen, *Mc Graw Hill* ,(19th Edition), (2010).
15. Lawrence J Gitman, '**Principles of Managerial Finance**', *Pearson,* (11th Edition),(2016).
16. K.K.Dewett, '**Modern Economic Theory**', *S.Chand,* (22nd Edition), (2005).

Reference Books:

5. Thursen Gerald, '**Engineering Economics**', *Prentice Hall,* (9th Edition), (2008).
6. D.M.Mithani, '**Managerial Economics**', *Himalaya Publishing House,* (8th Edition), (2016).

Websites:

4. www.economicshelp.org
5. www.rbi.org

EC 2205 Analog Communication Lab

Teaching Scheme:

Practical: 2 Hrs/Week

Examination Scheme:

Practical: 25 Marks

Credit: 1

Course objectives:

9. Explain mechanism of AM, FM generation and detection
10. Explain use of spectrum analyzer
11. Measurement of performance characteristics of superheterodyne radio receiver
12. Explain generation of flat top and natural sampling

Course Outcomes:

Having successfully completed this course, the student will be able to:

1. Draw waveforms AM, FM and explain the spectrum of the same
2. Observe effect of changes in modulating and carrier signal parameters on spectrum of AM and FM
3. Measure and plot performance characteristics of superheterodyne radio receiver
4. Draw sampling waveforms and observe effect of sampling frequency on detection of Pulse Amplitude Modulation

List of Experiments:

6. AM generation and calculation of modulation index with graphical and trapezoidal method
7. AM generation using class C amplifier and AM detection with simple and practical diode detector
8. DSB-SC generation and synchronous detection with balanced modulator
9. SSB generation and detection with phase shift method
10. FM generation with direct method and measurement of deviation ratio for different amplitudes of modulating signal
11. FM Detection using PLL
12. Measurement of performance characteristics of Superheterodyne AM Receiver
13. Generation and detection of pulse amplitude modulation (PAM)
14. Simulation of AM generation with suitable software
15. Simulation of FM generation with suitable software

EC 2206 Integrated Circuits and Applications Lab

Teaching Scheme:
Practical: 2 Hrs/Week

Examination Scheme:
In-Semester: 25 Marks
Credit: 1

Course Objectives:

1. To measure Op-Amp performance parameters and understand the difference between ideal and practical values for different ICs
2. To design and implement linear and non-linear applications of Op-Amp and verify the functionality

Course Outcomes:

Having successfully completed this course, the student will be able to:

6. Design Op-Amp based circuits
7. Select an appropriate Op-Amp IC for given application
8. Construct Op-Amp based circuits and analyse their performance

List of Practicals

4. Verify virtual ground and virtual short concept in inverting and non-inverting configuration.
5. Measure Op-Amp parameters and compare with the specifications: Input bias current, input offset current, input offset voltage, slew rate, CMRR.
6. Design, build and test integrator for given frequency fa.
7. Design, build and test three Op-Amp instrumentation amplifiers for typical application.
8. Build and test precision half and full wave rectifier.
9. Design, build and test Schmitt trigger and plot transfer characteristics.
10. Design, build and test square and triangular waveform generator.
11. Build and test 2 bit R-2R ladder DAC.

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EC 2207 Object Oriented Programming Lab

Teaching Scheme
Practicals: 4 Hours/Week

Examination Scheme
Oral: 25 Marks
Credits: 2

Course Objectives:

4. Exposure to object-oriented design and the concepts of encapsulation, abstraction, inheritance, and polymorphism
5. Implement, test and debug programs in the object-oriented paradigm.

Course Outcomes:

3. Apply the concepts of data encapsulation, inheritance and polymorphism in C++
4. Develop programs in Java utilizing the basic constructs.
5. Apply the concepts of polymorphism, inheritance and exception handling to develop Java programs.
6. Utilize the concepts of multi-threading & applets in Java programming.

List of Experiments

Write a program in C++ :

13. To sort the numbers in an array using separate functions for read, display, sort and swap. Objective is to learn the concepts of input/output, functions and call by reference in C++.
14. To perform the following operations on Complex numbers: Add, subtract, multiply, divide, complex conjugate. The objective is to learn the concepts of classes and objects.
15. To implement a Stack. Design the class for stack and the operations to be performed on stacks using constructors and destructors.
16. To implement a database of people having different professions e.g. engineer, doctor, student etc. using the concept of multiple inheritance.
17. Write a program in Java:
    i) To find factorial of a number
    ii) To display first 50 prime numbers
    iii) To find sum and average of N numbers
18. To implement a calculator with simple arithmetic operations such as add, subtract, multiply, divide and factorial using switch case and other simple Java statements
19. To define a class rectangle with the data fields width, length, area and colour. Create two objects of rectangle and compare their area and colour.
20. To sort i) List of integers ii) List of names
21. To add two matrices. The objective is to learn arrays in Java.
22. Write a program in Java to implement multi-level inheritance. Objective is to learn the concepts of inheritance in Java.
23. Write a Java program which uses TRY and CATCH for exception handling.
24. Write a program to create multiple threads and demonstrate how two threads communicate with each other.
25. Create an Applet with three text fields and four buttons ADD, SUBTRACT, MULTIPLY and DIVIDE.