Shri Vile Parle Kelavani Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

Scheme and detailed syllabus (DJS22)

Second Year B. Tech

in

(Semester IV)

Program: Electronics and Telecommunication Engineering	S. Y. B. Tech	Semester: IV
Course: Engineering Mathematics - IV (DJS22EC401)		
Course: Engineering Mathematics - IV Tutorial (DJS22ET401)		

Pre-requisite:

1. Engineering Mathematics - III (DJS22EC301)

Objectives:

To build the strong foundation in Mathematics of learner needed for the field of Electronics and Telecommunication Engineering learner would be able

1. To understand the concept of Random Variables.
2. To test the hypothesis of samples.
3. To apply the concepts of Linear Algebra.

Outcomes: On completion of the course, the learner will be able to:

1. Apply theory of probability in identifying and solving relevant problems.
2. Differentiate random variables through the use of cumulative distribution function (CDF), probability density function (PDF), probability mass function (PMF) as well as joint, marginal and conditional CDF, PDF and PMF.
3. Understand major types of probability sampling method and indicate when each is preferred.
4. Understand the theory of linear algebra
5. Apply theory of eigensystems to principal component analysis.

Engineering Mathematics - IV (DJS22EC401)		
Unit	**Description**	**Duration**
1	**Introduction to Probability and Random Variable:** Conditional probability, Joint probability, Bayes' theorem, Independence of events, Definition of Random Variable. Discrete and Continuous random variables, probability mass function, probability density function, probability distribution function, Expectation, Variance and Moments of random Variable, Binomial, Poisson and Normal (Gaussian) distributions.	**08**
2	**Operations on One and Multiple Random Variable:** Functions of a random variable and their distribution and density functions, Pairs of random variables, Joint CDF, Joint PDF, Independence, Conditional CDF and PDF, Conditional Expectation, One function of two random variables, two functions of two random variables; joint moments, joint characteristic function, covariance, and correlation-independent, uncorrelated and orthogonal random variables.	**07**
3	**Sampling Theory and Distribution:** Central limit theorem and its significance, Sampling distribution: Population distribution, parameter and statistics, Z – distribution, Student's t-distribution, Chi-square distribution.	**04**
4	**Test of Hypothesis:** Hypothesis testing: Test of significance, null and alternative hypothesis, type I and type II error, factors affecting Type II error, probability of Type II error, power of test, p Value, critical region, level of significance. One tailed and Two tailed Test, Large sample (Z-Test) :-Test of significance of Mean of the sample and test of significance difference of means of two samples, Small sample (t-Test) :-Test of significance of Mean of the sample and test of significance difference of means of two samples(dependent and independent),	**06**

	Chi-square test: Test of goodness of fit and independence of attributes, contingency table	
5	**Basics of Linear Algebra:** Vector Spaces, Subspaces, Span, Basis, Dimension, Rank, Linear transformations, Rank nullity theorem, Inner Product Space, Gram Schmidt Orthogonalization Process.	**06**
6	**Matrix theory:** Eigenvalues and Eigenvectors, properties of Eigenvalues and Eigenvectors, Cayley- Hamilton theorem, Examples based on verification of Cayley-Hamilton theorem, Similarity of matrices, Diagonalization of matrices, Function of square matrix, Quadratic forms over real field, Reduction of quadratic form to a diagonal, canonical form, Rank, index and signature of quadratic form, class value of quadratic forms, definite, Semi-definite and indefinite.	**08**
	Total	**39**

Minimum eight tutorials from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Engineering Mathematics - IV Tutorial (DJS22ET401)	
Tut.	**Suggested Tutorials**
1	Conditional probability and Bayes' theorem.
2	Random variable
3	Binomial, Poisson, and Normal distribution
4	Function of one random variable.
5	One function of two random variable and two function of two random variables.
6	Central Limit Theorem and Sampling distribution
7	Test of hypothesis (parametric)
8	Test of hypothesis (non-parametric)
9	Linear algebra
10	Eigen system
11	Quadratic forms

Books Recommended:

Textbook:

1. T. Veerarajan, *Probability, Statistics and Random Processes*, McGraw Hill Publication, 3rd Edition, 2017.
2. Gareth Williams, *Linear Algebra with Application*, Jones and Bartlett, 9th Edition, 2017.

Reference Books

1. Papoulis and S. Unnikrishnan Pillai, *Probability, Random Variables and Stochastic Processes*, McGraw Hill, 4th Edition, 2017.
2. Seymour Lipschitz and Marc Lipson, *Schaum's Outline of Linear Algebra*, Mc-Graw Hill Publication, 3rd Edition, 2017.
3. S. C. Gupta and V. K. Kapoor, *Fundamental of Mathematical Statistics*, Sultan Chand and Sons, 12th Edition, 2020.

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Program: Electronics and Telecommunication Engineering	**S. Y. B. Tech**	**Semester: IV**
Course: Integrated Circuits (DJS22EC402)		
Course: Integrated Circuits Laboratory (DJS22EL402)		

Pre-requisite:

1. Basic Electrical Engineering & Digital Electronics (DJS22FECBE)
2. Electronic Circuit Design (DJS22EC302)
3. Digital System Design (DJS22EC303)

Objectives:

1. To understand the concepts, and working principle of integrated circuits.
2. To design and analyze different circuits as well as systems for various applications using integrated circuits.

Outcomes: On completion of the course, the learner will be able to:

1. Describe the physical operation of integrated circuits using Op-Amps.
2. Analyze linear and non-linear Op-Amp applications.
3. Design various applications using Op-Amps, Timers, and special ICs.
4. Implement different types of applications using various Analog ICs with proper justifications.

Integrated Circuits (DJS22EC402)		
Unit	**Description**	**Duration**
1	**Introduction to Operational Amplifiers:** Block diagram of Op-Amp, analysis of basic differential amplifier circuit configurations using MOSFETs, MOSFET differential amplifier with active load, effect of swamping resistor, current mirror circuit, current sources using MOSFETs (Widlar current source, and Wilson current source), voltage sources and references, DC level shifters, Op-Amp symbol and terminals, ideal Op-Amp and practical Op-Amp characteristics, Op-Amp parameters, open loop and closed loop configurations.	**10**
2	**Applications of Operational Amplifier:** **Amplifiers:** Inverting, non-inverting, buffer, summing, difference, integrator, differentiator, current, instrumentation, log and antilog, **Active Filters:** First and second order active LPF and HPF, switched capacitor filters; **Converters:** Current to voltage, voltage to current, **Comparators:** Inverting comparator, non-inverting comparator, zero crossing detector, window detector, peak detector, sample and hold circuit, Schmitt trigger, **Waveform generator:** Square wave generator, triangular wave generator; **Precision rectifier:** Half wave and full wave.	**10**

3	**Analog to Digital and Digital to Analog Converters:** Performance parameters of ADC, single ramp ADC, ADC using DAC, dual slope ADC, successive approximation ADC, flash ADC, Performance parameters of DAC, binary weighted register DAC, R/2R ladder DAC, inverted R/2R ladder DAC.	**08**
4	**Special Purpose Integrated Circuits:** **IC 555(timer):** Functional block diagram, working, design of astable and monostable multivibrator using Timer 555, application of IC 555 as pulse position modulator; **IC 566 (VCO):** Functional block diagram, working and application as frequency modulator; **IC 565 (PLL):** Functional block diagram, working and application as FSK demodulator.	**06**
5	**Voltage Regulators:** **Three terminal regulators:** Functional block diagram, working and design of three terminal fixed (78XX, 79XX series) and three terminal adjustable (LM 317, LM 337) voltage regulators; **General purpose voltage regulator:** Functional block diagram, working and design of general purpose 723 (LVLC, LVHC, HVLC and HVHC) with current limit and current fold-back protection.	**08**
	Total	**42**

Integrated Circuits Laboratory (DJS22EL402)	
Exp.	**Suggested Experiment List**
1	Design Inverting and Non-inverting amplifier using Op-Amp (IC 741).
2	Design Integrator and Differentiator using Op-Amp (IC 741).
3	Design Summing /Difference amplifier using Op-Amp (IC 741).
4	Second Order Low Pass filter using Op-Amp (IC 741).
5	Design Square wave and Triangular wave generator using Op-Amp (IC 741).
6	Design Schmitt trigger using Op-amp (IC 741).
7	Design Half wave and Full wave Precision Rectifier using Op-Amp (IC 741).
8	Design R-2R Ladder DAC using Op-Amp (IC 741).
9	Design Astable Multivibrator using IC 555.
10	Design Voltage Regulator using IC 723.
11	To perform AC and DC analysis of MOSFET based differential amplifier using Spice Tool.
12	Instrumentation Amplifier using Spice Tool.

Minimum eight experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text books:

1. Ramakant A. Gayakwad, *Op-Amps and Linear Integrated Circuits*, Pearson Prentice Hall, 4th Edition, 2020.
2. D. Roy Choudhury and S. B. Jain, *Linear Integrated Circuits*, New Age International Publishers, 4th Edition, 2018.

Reference Books:

1. Sergio Franco, *Design with operational amplifiers and analog integrated circuits*, Tata McGraw Hill, 4th Edition, 2015.
2. R. F. Coughlin and F. F. Driscoll, *Operation Amplifiers and Linear Integrated Circuits*, Prentice Hall, 6th Edition, 2000.
3. David A. Bell, *Operation Amplifiers and Linear Integrated Circuits* , Oxford University Press, 3rd Edition, 2011.
4. Millman Halkias, *Integrated Electronics*, McGraw-Hill Electrical and Electronic Engineering Series, 1st edition, 2001.

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Program: Electronics and Telecommunication Engineering	S. Y. B. Tech	Semester: IV
Course: Electromagnetic Wave Propagation (DJS22EC403)		
Course: Electromagnetic Wave Propagation Tutorial (DJS22EL403)		

Pre-requisite:

1. Engineering Mathematics-III (D DJS22EC301)

Objectives:

1. To learn concept of static and time varying electromagnetic fields.
2. To solve problems related to EM fields using Vectors and Partial differential equations.
3. To learn Electromagnetic radiation and propagation in space and within transmission lines.

Outcomes: On completion of the course, the learner will be able to:

1. Compute electric and magnetic fields for symmetrical charge and current configurations using basic principles of electromagnetics.
2. Explain coupling between electric and magnetic fields through Faraday's law, displacement current and Maxwell's equations.
3. Explain Wave Polarization and propagation in different media.
4. Determine the parameters of transmission lines for various frequencies.

Electromagnetic Wave Propagation (DJS22EC403)		
Unit	**Description**	**Duration**
1	**Coordinate system transformation and vector calculus:** Cartesian, cylindrical and spherical coordinate, Differential length, area and volume, line surface and volume integrals, Del Operator, Gradient of scalar, Divergence of a vector and Divergence Theorem, Curl of a Vector and Stoke's Theorem, Laplacian of a scalar.	**06**
2	**Electrostatics:** Coulomb's Law, Gauss's Law and its applications, Electric Potential, Relationship between E and V, Electric Dipole and flux lines, Convection and Conduction Currents, Electric Boundary Conditions, Poisson's and Laplace's Equations, Uniqueness Theorem, General Procedure for solving Poisson's or Laplace's Equations.	**08**
3	**Magnetostatics:** Biot-Savart's Law, Ampere's Circuital Law and its applications, Magnetic Flux density, Maxwell's equations for Static Fields, Magnetic Scalar and Vector potentials, Magnetic boundary conditions.	**08**
4	**Time varying Fields:** Faraday's Law, Transformer and Motional Electromotive Forces, Displacement Current Maxwell's equations in point form and integral form, Boundary conditions for time varying field, magnetic vector potential, Time harmonic fields.	**08**
5	**Transmission Lines:** Parameters, Transmission line equations, Input impedance, reflection coefficient, Standing wave ratio.	**06**
6	**Electromagnetic Wave Propagation:** Derivation of Wave equation and its solution, Wave Propagation in lossy dielectrics, Plane waves in loss less dielectrics, free space and good conductors, Power and Poynting Vector, Reflection of a Plane wave at normal incidence and oblique incidence.	**08**

	Modes of Wave Propagation: Ground Wave Propagation, Sky Wave Propagation, Space Wave Propagation.	
	Total	**44**

Electromagnetic Wave Propagation Laboratory (DJS22EL403)	
Exp.	**Suggested Experiment List**
1	Numericals on Electrostatics
2	Numericals on Electric Boundary conditions
3	Numericals on Poisson's and Laplace's Equations
4	Numericals on Magnetostatics
5	Numericals on Vector Potentials
6	Numericals on Time varying fields
7	Numericals on Maxwell Equations
8	Transmission line impedance calculations
9	Transmission line reflection coefficient calculations
10	Numericals on Wave Propagation in different material
11	Numericals on Normal and Oblique incidence
12	Sky and Space wave propagation

Minimum eight experiments from the above suggested list or any other experiment based on syllabus to be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text books:

1. William H. Hayt and John A Buck, *Engineering Electromagnetics*, Tata McGraw-Hill Publishing Company Limited, 9th Edition, 2020.
2. Matthew N. O. Sadiku, S. V. Kulkarni, *Principles of electromagnetics*, Oxford University Press, 6th Edition, 2015.

Reference Books:

1. Edward C. Jordan, Keth G. Balmin, Electromagnetic Waves & Radiating Systems, Pearson Publications, 2nd Edition, 2015.
2. Reinhold Ludwig, Pavel Bretchko, *RF Circuit Design Theory and Applications*, Pearson, Publications, 2nd Edition, 2011.
3. R. K. Shevgaonkar, *Electromagnetic Waves*, Tata McGraw Hill, 1st Edition, 2017

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Program: Electronics & Telecommunication Engineering	S.Y. B. Tech	Semester: IV
Course: Microcontroller & Applications-I (DJS22EC404)		
Course: Microcontroller & Applications-I Laboratory (DJS22EL404)		

Pre-requisite:

1. Basic Electrical Engineering & Digital Electronics (DJS22FECBE)
2. Digital System Design (DJS22EC303)

Objectives:

1. To develop background knowledge and core expertise in microcontrollers.
2. To understand peripheral devices and their interfacing to microcontrollers.
3. To write programs for microcontrollers and their applications in Assembly language.

Outcomes: On completion of the course, the learner will be able to:

1. Identify different functionalities and architecture of 8051 microcontrollers.
2. Identify different hardware components and use relevant software for programming of microcontroller-based development system.
3. Write assembly language programs for microcontroller-based systems using instruction set.
4. Interface different input/output devices with microcontroller for various applications.

Microcontroller & Applications-I (DJS22EC404)		
Unit	**Description**	**Duration**
1	**Introduction to Microcomputer System:** Block diagram of microprocessor-based system: CPU, I/O Devices, Clock, Memory, Concept of Address, Data and Control Bus and Tristate logic, Need of Assembly Language and its Comparison with higher level languages, Need of Assembler and Compiler and their comparison.	**07**
2	**8051 Microcontroller:** Features, architecture and pin configurations, CPU timing, Input / Output ports, Memory organization, Counters and timers, Interrupts, Serial Communication.	**10**
3	**8051 Programming:** Instruction set, Addressing mode, Assembler Directives Programs related to: arithmetic, logical, delay, input, output, timer, counters, port, serial communication, and interrupts.	**10**
4	**Memory interfacing with 8051:** RAM, ROM, EPROM and Memory mapping.	**06**
5	**Interfacing and Applications:** Interfacing of Display: LED, Seven Segment display, and LCD, DC Motor, Stepper motor Relay and UART.	**07**
	Total	**40**

Microcontroller & Applications-I Laboratory (DJS22EL404)	
Exp.	**Suggested experiments**
1	To find smallest and largest number from given data string using 8051.
2	To perform addition, subtraction, multiplication & division of 8-bit numbers.
3	To exchange data blocks using 8051.
4	To arrange data series in ascending & descending order.
5	To find even and odd numbers from data string.
4	To blink LED and generate various pattern using 8051.
5	To interface 7-segment display with 8051.
6	To display the message on LCD using 8051.
7	To transfer and receive data serially using 8051.
8	To generate waveform using 8051.
9	To measure pulse width using 8051.
10	To interface temperature sensor and display room temperature on display.
11	To interface DC motor using 8051.
12	To interface relay and turn ON/OFF the bulb using 8051.

Minimum eight experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text books:

1. M. A. Mazidi, J. G. Mazidi and R. D. Mckinlay, *The 8051 Microcontroller & Embedded systems*, Pearson Education India, 1st Edition, 2007.
2. Lyla Das, *Embedded Systems: An Integrated Approach*, Pearson Publication, 1st Edition, 2012.

Reference Books:

1. C. Kenneth J. Ayala and D. V. Gadre, *The 8051 Microcontroller & Embedded system Using assembly & C*, Cengage Learning Publication, 1st Edition, 2010.
2. I. Scott Mackenzie, Raphael C. W. Phan, *The 8051 Microcontroller*, Pearson International Publication, 4th Edition, 2007.
3. Ajay Deshmukh, *Microcontrollers*, Tata McGraw Hill Publication, 2nd Edition, 2006.

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Program: Electronics and Telecommunication Engineering	S. Y. B. Tech	Semester: IV
Course: Data Analytics Laboratory (DJS22EL405)		

Pre-requisite:

1. Python Programming Laboratory (DJS22EL306)

Objectives:

1. Basics of data modeling.
2. Data processing techniques.
3. Supervised learning methods.
4. Unsupervised learning methods.
5. Dimensionality Reduction.
6. Ensemble methods.

Outcomes: On completion of the course, the learner will be able to:

1. Perform data cleaning and transformations on a given dataset.
2. Perform data modeling using regression and classification methods.
3. Apply dimensionality reduction on high dimensional datasets.
4. Apply the concepts of Neural Network on non-linear datasets.
5. Apply ensemble techniques for imbalance datasets.
6. Apply clustering techniques for unsupervised datasets.

Data Analytics Laboratory (DJS22EL405)	
Exp.	**Suggested Experiment List**
1	Analysis of different types of datasets.
2	Plotting of probability distribution using different dataset.
3	Plotting and visualization of dataset using different types of graphs.
4	Different types data cleaning methods.
5	Implementation of logistic regression model for predictive analysis.
6	Implementation of linear regression model for predictive analysis.
7	Implement PCA on dataset with high dimensionality and perform prediction using KNN.
8	Implement clustering methods on unsupervised dataset.
9	Hypothesis testing for given dataset.
10	ANOVA technique using dataset.

Minimum eight experiments from the above suggested list.

Books Recommended:

Text books:

1. Max Kuhu & Kjell Johnson, *Applied Predictive Modelling*, Springer Publication, 1st Ediition.
2. Olson, David L., Wu, Desheng, *Predictive Data Mining Models*, Springer, 1st Edition 2020.

Reference Books:

1. Alvaro Fuentes, *Hands-On Predictive Analytics with Python: Master the Complete Predictive Analytics Process, from Problem Definition to Model Deployment*, Packt Publishing, 2nd edition 2019.
2. Ai Publishing, *Data Pre-processing with Python for Absolute Beginners: Step-by-Step Guide with Hands-on Projects and Exercises*, Apex Persuasion 2020.

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Program: Electronics and Telecommunication Engineering	**S. Y. B. Tech**	**Semester: III**
Course: Database Management System Laboratory (DJS22EL406)		

Pre-requisite:

1. Structured programming using C (DJS22FEC12)
2. Object oriented programming using JAVA (DJS22FEC12)

Objectives:

1. Learn and practice data modeling using the entity-relationship and developing database designs
2. Understand the use of Structured Query Language (SQL) and learn SQL syntax

Outcomes: On completion of the course, the learner will be able to:

1. Analyze a case study and create ER diagram of the scenario and able to create Database schema from this using given software and SQL.
2. Write basic SQL queries to apply constraints, insert rows, do basic operations like alter, update and delete, to use basic aggregate functions and retrieve information from databases.
3. Perform normalization on tables by analyzing functional dependencies.
4. Write SQL queries to make joins and views on table.
5. Perform nested queries and triggers.

	Database Management System Laboratory (DJS22EL406)	
Unit	**Description**	**Duration**
1	**Introduction to databases:** Characteristics of databases, Users of Database system, Database architecture, Data abstraction, Different data models.	**02**
2	**The Entity-Relationship (ER) Model:** Types of entities and Attributes, Keys, Relationship constraints: Cardinality and Participation.	**04**
3	**Relational Database**: Relational schema and concept of keys, Mapping ER model to Relational Model, Constraints, types of constrains, Integrity constraints, Normalization 1NF,2NF,3NF, BCNF.	**06**
4	**SQL:** DDL & DML commands, Specifying Constraints in SQL, Basic Retrieval Queries in SQL, Views in SQL, aggregate functions, nested sub queries, JOINTS, Triggers.	**08**
	Total	**20**

	Database Management System Laboratory (DJS22EL406)
Exp.	**Suggested experiments**
1	Design an Entity-Relationship (ER) model according to the requirement of organization.
2	Convert the designed ER model to a Relational Database. Create this database in MySQL/SQL Server (any other suitable software) with required tables. Apply the constraints like Primary Key, Foreign key, NOT NULL to the tables.

3	Write SQL statements for inserting rows (INSERT) and perform ALTER, UPDATE and DELETE
4	Perform aggregate functions
5	Identify dependencies in a table and accordingly convert it to 1NF, 2NF, 3NF and BCNF
6	Perform SELECT statement for retrieval of data from Database
7	Perform various JOIN operations on tables
8	Create views and access data from it using SQL statements
9	Perform queries for triggers
10	Perform Nested queries
11	Mini Project

Minimum eight experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text books:

1. A Silberschatz, H Korth, S Sudarshan, *Database System and Concepts*, McGraw Hill, 7th Edition, 2019.
2. Ramez Elmasri, Shamkant B. Navathe, *Fundamentals of Database System*, 7th Edition, Person, 2017.

Reference Books:

1. Peter Rob, Carlos Coronel, *Database Systems Design, Implementation and Management*, 8th Edition Cengage Learning, 2007.
2. P.S. Deshpande, *SQL and PL/SQL for Oracle 11g Black Book*, Dreamtech Press, 2011.
3. Mark L. Gillenson, Paulraj Ponniah, *Introduction to Database Management*, Wiley, 2008.

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Program: Electronics and Telecommunication Engineering	S. Y. B. Tech	Semester: IV
Course: Innovative Product Development–II (DJS22A5)		

Pre-requisite:

1. Electronics Circuit Design (DJS22EC302)
2. Digital Circuit Design (DJS22EC303)

Objectives:

1. To design and implement the problem statement as per the project requirement.
2. To improve the team building, communication and management skills.
3. To approach at a problem solution by learning various ideas and concepts across different disciplines.

Outcomes: On completion of the course, learner will be able to:

1. Use project based learning that allows students to identify and transfer existing ideas into new contexts andapplications thereby improving individual grooming.
2. Present their research in the form of a technical report and thereby improve the technical communicationskill.
3. Demonstrate the ability to work in teams and manage the conduct of the research study.
4. Integrate and synthesize different perspectives from relevant disciplines, which help them to get internships,jobs and admission for higher studies.

Syllabus:

- Domain knowledge (and beyond as applicable) needed from the following areas for the effective implementation of the project.
- Microcontroller and Embedded Systems, Signal Processing, Microwave and Antennas, Networking and Internet of Things, Data science and Big data, Communication, Web and Application development, Robotics, AI and Machine learning etc.
- Above areas can be updated based on the technological innovations and development needed for specific project.

Guidelines:

The main purpose of this course is to improve the student's technical skills and paper writing skills by integrating key aspect of writing, presentation and teamwork opportunities. Each project group is already undergone project topic allotment, followed by two reviews in their third semester and during this semester, students are expected to continue the project work.

1. Each group is reviewed twice in a semester (January and March) and grades are allotted based on thevarious points mentioned in the evaluation scheme.
2. In the first review of this semester, each group is expected to complete 50% of project and write first draft ofthe technical report.
3. In the second review of this semester, each group is expected to complete 80% of project and submit final draft of the technical report.

4. The technical paper written by each group is published in DJ Strike magazine with ISBN number.
5. Interaction with alumni mentor is also appreciated for the improvement of project.

Evaluation Scheme:
Semester review (B):

Each group is reviewed twice in a semester by the faculty guide and faculty coordinators, based on the following criteria:

1. Project progress
2. Documentation/Technical paper writing
3. Key findings
4. Validation of results
5. Product Development

The final certification and acceptance is subject to satisfactory performance of the project.

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