COURSE DESCRIPTION

Name : **VEERAV CHEBROLU**

Dual degree from : **Birla Institute of Technology And Science, Pilani - Hyderabad**

M.Sc. (Hons.) *Mathematics,*
B.E. (Hons.) *Electronics & Communication*

(2013 - 2018)

Institute homepage **:** https://www.bits-pilani.ac.in/hyderabad/

This document contains detailed course catalogues (lecture wise breakdown) for *Mathematics*/*Computer Science/Electronics & Communication* courses.

Note : a very brief overview of courses can also be accessed from university webpage here :

M.Sc. Mathematics : https://www.bits-pilani.ac.in/hyderabad/Mathematics/Courses

B.E. Electronics and Communications : https://www.bits-pilani.ac.in/uploads/A.Hyd%202014-15/EE/BE-ECE%20Courses%20Description.pdf

NOMENCLATURE:

[a b c] represents a: a units of theory; b: b units of lab; c: Total units

3 units of theory is 3 lectures per week + 1 tutorial (meant for problem solving) per week .

Each lecture and tutorial is for 1hour. Each lab session is for 2hours.

INDEX

Mathematics

Sr. Number	Course Number	COURSE NAME	UNITS
1	MATH F111	Mathematics 1 (Multivariate Calculus)	[3 0 3]
2	MATH F112	Mathematics 2 (Linear Algebra & Complex Analysis)	[3 0 3]
3	MATH F113	Probability & Statistics	[3 0 3]
4	MATH F211	Mathematics 3 (Differential Equations)	[3 0 3]
5	MATH F212	Optimization	[3 0 3]
6	MATH F214	Elementary Real Analysis	[3 0 3]
7	MATH F215	Algebra 1	[3 0 3]
8	MATH F243	Graphs & Networks	[3 0 3]
9	MATH F213	Discrete Mathematics	[3 0 3]
10	MATH F241	Mathematical Methods	[3 0 3]
11	MATH F242	Operations Research	[3 0 3]
12	MATH F244	Measure & Integration	[3 0 3]
13	MATH F311	Introduction to Topology	[3 0 3]
14	MATH F312	Ordinary Differential Equations	[3 0 3]
15	MATH F313	Numerical Analysis	[3 0 3]
16	MATH F341	Introduction to Functional Analysis	[3 0 3]
17	MATH F342	Differential Geometry	[3 0 3]
18	MATH F343	Partial Differential Equations	[3 0 3]
19	MATH F231	Number Theory	[3 0 3]
20	MATH F353	Statistical Inference & Applications	[3 0 3]
21	MATH F456	Cosmology	[3 0 3]

Computer Science

Sr. Number	Course Number	COURSE NAME	UNITS
1	CS F111	Computer Programming	[3 1 4]
2	ECE F215	Digital Design	[3 1 4]
3	ECE F241	Microprocessing & Interfacing	[3 1 4]
4	BITS F343	Fuzzy Logic & Applications	[3 0 3]
5	EEE F435	Digital Image Processing	[3 0 3]
6	CS F342	Computer Architecture	[3 1 4]
7	ECE F343	Communication Networks	[3 0 3]
8	ECE F344	Information Theory & Coding	[3 0 3]

Electronics & Communication

Sr. Number	Course Number	COURSE NAME	UNITS
1	EEE F111	Electrical Sciences	[3 0 3]
2	ECE F211	Electrical Machines	[3 1 4]
3	ECE F212	Electromagnetic Theory	[3 0 3]
4	ECE F214	Electronic Devices	[3 0 3]
5	ECE F242	Control Systems	[3 0 3]
6	ECE F243	Signal Systems	[3 0 3]
7	ECE F244	Microelectronic Circuits	[3 0 3]
8	ECE F311	Communication Systems	[3 1 4]
9	ECE F314	EM Fields & Microwave Engg	[3 0 3]
10	ECE F434	Digital Signal Processing	[3 1 4]
11	ECE F341	Analog Electronics	[3 1 4]
12	ECE F418	Modern Communication Tech	[3 0 3]

INSTRUCTION DIVISION
FIRST SEMESTER 2017-18
Course Handout Part-II

01-08-2017

In addition to part-I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No. : MATH F111
Course Title: MATHEMATICS I
Instructor-in-charge: A. MICHAEL ALPHONSE
Name of Instructors: B. Mishra, D. K. Satpathi, A.Michael Alphonse, K.Venkata Ratnam, Jagan Mohan J, Kishore Kumar, Manish Kumar, Sharan Gopal, Sumit Kumar V, TSL Radhika, R.Revathi, S. Pratik Premadarshi Ray, Sankarsan Tarai,

Scope and Objective of the Course:

Calculus is needed in every branch of science and engineering, as all dynamics is modeled through differential and integral equations. Functions of several variables appear more frequently in science than functions of a single variable. Their derivatives are more interesting because of the different approaches in which the variables can interact. Their integrals occur in several areas. All these lead in a natural way to functions of several variables.

Text Book:

1. George B. Thomas, Maurice D. Weir and Joel Hass, *Thomas' Calculus*, Pearson, 12th Edition, 2016.

Reference Books:

1. Erwin Kreyszig, *Advanced Engineering Mathematics*, 8th Edition, Wiley-India, 2007.
2. James Stewart, *Calculus*, 5th Edition, Cengage Learning, 2003.
3. Monty J. Strauss, Gerald L. Bradley and Karl J. Smith, *Calculus*, 3rd Edition, Pearson, 2007.

Course Plan:

Lect. No.	**Learning Objectives**	**Topics to be Covered**	**Reference to Textbook: Chap / Sec**
1	Overview of the course	-	-
2-3	To explain how calculus of one variable real-valued functions are related to vector valued functions.	Limit, continuity and differentiability of vector functions, arc length, velocity and unit tangent vector	13.1, 13.2(only Integrals of Vector Functions is included, Projectile Motion is

			excluded), 13.3
4-6	To explain the concepts of curvature and torsion.	Curvature, normal vector, torsion and binormal vector, tangential and normal components of velocity and acceleration	13.4, 13.5
7-8	How to prove continuity, discontinuity and existence of limits for the functions of several variables.	Functions of several variables, level curves, limits, continuity	14.1, 14.2
9-11	To define partial derivatives and explain the function of function rules for functions of several variables	Partial derivatives, chain rule	14.3, 14.4
12-13	To explain how to find the derivative along a particular direction	Directional derivative, gradient vectors, tangent planes and normal line, Estimating the change in a specific direction, Linearization of functions of two and three variables, The error in the standard linear approximation	14.5, 14.6
14-15	To explain the concepts of local maximum and minimum for functions of several variables	Maximum, minimum and saddle points of functions of two or three variables, constrained maxima and minima – method of Lagrange multipliers.	14.7, 14.8
16-19	How to obtain length of a polar curve and area of a surface of revolution of a polar curve?	Polar Coordinates, Graphing in Polar Coordinats, Length of a polar curve, area of a surface of revolution, Conic Sections	11.3-11.6
20-21	How formula for area in polar coordinates can be found through polar double integral?	Double integrals, area, change of integrals to polar coordinates. Double integrals in polar form	15.1 - 15.4
22-24	To identify which type of Integral evaluates volume of a solid in a simpler way	Triple integral, integral in Cylindrical and Spherical coordinates, Substitutions in multiple integrals	15.5, 15.7, 15.8
25-30	To explain the equivalent definitions of conservative field. How Green's theorem can simplify evaluation of line integrals?	Line integral, work, circulation, flux, path independence, potential function, conservative fields, Green's theorem in the plane	16.1 – 16.4
31-35	To explain the concept of surface measure and how to apply Stokes theorem	Surface area and surface integral, Stokes' theorem, Gauss divergence theorem	16.5 - 16.8
36-40	To explain the convergence of infinite series with examples & counter examples	Sequence of real numbers, frequently occurring limits, infinite series different tests of convergence, series of nonnegative terms, absolute and conditional convergence, alternating series	10.1 – 10.6
41-42	To explain the power series and their properties	Power series, Taylor and Maclaurin series	10.7 – 10.8

Evaluation Scheme:

EC No.	Evaluation Component	Duration	Weightage	Date, Time	Nature of Component
1.	Midsemeater Examination	90 mts	35%	9/10 1.30 -- 3.00 PM	Open Book
2.	Announced Tutorial tests		20%	There will be three tutorial tests conducted at tutorial hours, out of three tests best two will be taken. No makeup will be granted for tutorial tests.	Closed Book
3.	Comprehensive Examination	3 hrs	45%	02/12 FN	Closed Book

Chamber consultation hour: To be announced in the class.

Make-up Policy:
Make-up will be given only for very genuine cases and prior permission has to be obtained from I/C.

Notices: The notices concerning this course will be displayed on the CMS Notice Board only.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

INSTRUCTOR IN -CHARGE
MATH F111

SECOND SEMESTER 2019-2020
Course Handout (Part-II)

06-01-2020

In addition to Part-I (General Handout for all Courses appended to the time table) this portion gives further specific details regarding the Course.

Course No. : MATH F112

Course Title : MATHEMATICS-II

Instructor-Incharge : A. MICHAEL ALPHONSE

Instructors : A Ramu, Anil Nemili, Deepika, Jhuma Sen Gupta, K Bhargav Kumar, Kishore Kumar, PK Sahoo, Pratyusha Chattopadhyay, Sharan Gopal, TSL Radhika, Aleena Philip, Anjali P V, Faiz Imam, G Vinodkumar Rajlingappa, K Panduranga, Nakidi Shravani, Sri Sakti Swarup Anupindi

1. Scope and Objective of the Course: The course is meant as an introduction to Linear Algebra and Theory of Functions of Complex Variable and their applications.

2. Course Description: System of linear equations, Eigenvalues and eigenvectors, Vector spaces, Basis and dimension of vector spaces, Linear transformations, Range and kernel. Function of complex variables and their analyticity, Elementary functions, Integration, Taylor and Laurent series expansions, Calculus of residues and its applications.

3. Text Books:

(i) Linear Algebra with applications by G. Williams, 9th Edition, Jones & Bartlett Learning.
(ii) Complex Variables and Applications by R.V. Churchill and J.W. Brown, 8th Edition, McGraw-Hill Education.

4. Reference Books:

(i) Elementary Linear Algebra by Stephen Andrilli and David Hecker, 4th Edition, Elsevier
(ii) Elementary Linear Algebra, Applications version by H. Anton and C. Rorres, 10th Edition, John Wiley.
(iii) A First Course in Complex Analysis with Applications by Dennis G. Zill & Patrick Shanahan, 2nd Edition, 2009, Jones & Bartlett.

5. Course Plan:

Lec. No.	Learning Objectives	Topics to be covered	Chapter in the Text Book
A. LINEAR ALGEBRA (Text Book (i))			
1	Introduction to the Course and introduction to system of linear equations	Elementary row operations and Echelon form	1.1
2-3	Inverse of matrix, Solving system of linear equations and computing Eigenvalues and Eigenvectors	Solutions of linear systems of equations by Gauss Elimination, Gauss-Jordan method. RREF, Eigenvalues and Eigenvectors	1.1-1.2 2.4,3.4
4-12	Introduction to abstract vector spaces, finite and infinite dimensional vector spaces and related concepts.	Vectors in $\mathbb{R}^n$, linear combination, linear independence, Vector spaces, *Examples of unusual Vector spaces, subspaces, basis and dimension, **Shrinking a linearly dependent set to a Basis, **Extending a linearly independent set to a Basis, Rank of a matrix	4.1-4.5 *R1 : 4.1 **R1: 4.6
13-14	Understanding the change of basis	Coordinate vectors and change of Basis	5.1
15-17	Introduction to linear transformations, examples of linear transformations. understanding the link between linear transformations and matrices.	Linear transformations, kernel and range of linear transformation, Isomorphism, Some matrix transformations	4.8- 4.10 2.5, 2.6
18-19	Understanding the link between linear transformations and matrices.	Matrix of a Linear Transformation	5.2
B. COMPLEX VARIABLES (Text Book (ii))			
20-21	Quick revision of complex numbers and their properties.	Review	1-11
22	Evaluation of limits in complex plane. Testing continuity of complex valued functions.	Functions of a complex variable. Limit and continuity	12,15-18
23-27	Introduction to analytic functions. Singular points of a complex valued function.	Derivative, CR-equations, analytic functions, Harmonic functions	19-26
28-31	Study of elementary functions. These functions occur frequently all through the complex variable theory. Understanding multiple valued function, branch cut and branch point	Exponential, trigonometric, hyperbolic and Logarithmic functions, complex exponents, inverse functions.	29-36

32-33	Integrating along a curve in complex plane.	Contour integrals, anti-derivatives.	37-44
34-35	Techniques to find integrals of different functions over particular contours.	Cauchy-Goursat Theorem, Cauchy Integral Formula, Morera's Theorem, Liouville's Theorem.	46,48-52
	Application of complex variable theory in Abstract Algebra.	Fundamental Theorem of Algebra (Self Study)	53
36-37	Series expansion of a complex function, function To study different types of singular points.	Taylor Series and Laurent series.	57,59, 60,62
38-40	Calculating residues at isolated singular points.	Residues, Residue Theorem.	68-76
41	Application of complex integration to evaluate improper real integral.	Improper real integrals.	78-79

6. Evaluation Scheme:

EC No.	Evaluation Component	Duration	Weightage (%)	Date	Nature of Component
1.	Mid Semester Exam	90 min.	35	5/3 11.00 -12.30 PM	**CB**
2.	2 Assignments	Details will be announced in the class	20	Details will be announced in the class	**OB**
3.	Comprehensive Exam	180 min.	45	09/05 FN	**CB**

7. Notices: All notices about the course will be displayed on CMS.

8. Chamber Consultation Hour: To be announced in the class by the respective Instructors.

9. Make-up Policy: Prior permission is needed for makeup; makeup will be given only for genuine cases.

10. Total marks: 300

11. Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-In-Charge
MATH F112

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
HYDERABAD CAMPUS
INSTRUCTION DIVISION, SECOND SEMESTER 2016-2017
COURSE HANDOUT (Part II)

12-01-2017

In addition to Part I (General Handout for all courses appended to the time table) portion:

Course Number : **MATH F113**
Course Title : **Probability & Statistics**
Instructor-In charge : **D.K. SATPATHI**
Instructors : **B. Mishra**, K**. Venkata Ratnam, Kishore Kumar, Manish Kumar P.T.V. Praveen Kumar, Jagan Mohan J, Sumit Kumar V, Parbathi Sahoo, Pratik Premadarshi Ray.**

1. **Scope and objective of the course:**
   Probability theory deals with many real-life problems, which either inherently involve the chance phenomena or describing the behaviour of the system explicitly with statistical properties. Interpretation of the system behaviour in many engineering and sciences depends on concept of probability and statistics that familiarize with the computational and analytical aspects. The course deals with the basic properties of various distributions and other related things.
2. **Text Books:**
   Jay L Devore, Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage Learning, 2012.
3. **Reference Books:**
   1. Johnson, R.A.: Miller & Freund's Probability and Statistics for Engineers, 8th. Ed., PHI, 2011.
   2. Sheldon M. Ross: Introduction to Probability and Statistics for Engineers and Scientists, Fourth Edition, Elsevier, Academic Press, 2010.
   3. Walpole, R.E., Myers R.H., Myer S.L., Ye K.: Probability and Statistics for Engineers and Scientists, 8th Edition, Pearson Education, 2008.
4. **Lecture Plan:**

Lecture	Learning Objectives	Topic	Chapter in the Text Book
1	Probability theory makes predictions about experiments whose outcomes depend upon chance.	Introduction to probability, sample spaces and events	2.1
2-3	How to state the three axioms of probability and use them to derive basic facts about a probability function. Learn about three approaches of defining probabilities and their interpretations.	Axioms, Interpretations and Properties of Probability, Counting Techniques	2.2, 2.3

4-5	Introduce conditional Probability and its applications	Conditional Probability, Independence	2.4, 2.5
6-7	To gain knowledge on how to define a random variable and identify various important and commonly used discrete distributions.	Random Variables, Probability Distributions for Discrete Random Variables, Expected Values, Moment Generating Function (MGF)	3.1, 3.2, 3.3, 5.11 (R-1)
8-11		The Binomial Probability Distribution, Hypergeometric and Negative Binomial Distributions, Geometric Distribution, The Poisson Probability Distribution	3.4, 3.5, 3.6
12-13	To gain knowledge on various important and commonly used continuous distributions	Continuous Random Variables, Probability Density Functions, Cumulative Distribution Functions and Expected Values, MGF	4.1, 4.2, 5.11 (R-1)
14-19	To gain knowledge on most important continuous distribution (Normal distribution) and its applications in real life.	The Normal Distribution, The Exponential and Gamma Distributions, Chi-Square , Log Normal Distributions and Transformation Methods to Obtain Distributions	4.3, 4.4, 4.5, 6.7 (R-1)
20-21	Introduce simulation and how to simulate complex systems.	Simulation – Discrete and Continuous random variables	4.10, 5.14 (R – 1)
22-24	Develop probability models involve several random variables simultaneously	Jointly Distributed Random Variables, Expected Values, Covariance, and Correlation	5.1, 5.2
25-27	Introduce Statistics and their distributions.	Statistics and Their Distributions, The Distribution of the Sample Mean, The Distribution of a Linear Combination	5.3, 5.4, 5.5
28-29	How to estimate population's parameters.	Some General Concepts of Point Estimation, Methods of Point Estimation	6.1, 6.2
30-32		Basic Properties of Confidence Intervals, Large-Sample Confidence Intervals for a Population Mean, and Proportion Intervals Based on a Normal Population Distribution, Confidence Intervals for the Variance and Standard Deviation of a Normal Population	7.1, 7.2, 7.3, 7.4
33-35	Introduce concepts of hypothesis testing and its applications in real world problems	Hypotheses and Test Procedures, Tests About a Population Mean	8.1, 8.2
36-37		Tests Concerning a Population Proportion, P-Values	8.3, 8.4
38-39	Objective is how to exploit the relationship between two or more variables by introducing predictive models.	The Simple Linear Regression Model, Estimating Model Parameters	12.1-12.2

5. Evaluation Scheme:

EC No.	Evaluation Component	Duration	Weightage	Date & Time	Remarks
1	Test I	60 mins	30%	27/02, 10.00 - 11.00 AM	CB
2	Test II	60 mins	30%	01/04, 10.00 - 11.00 AM	CB
4	Comp. Exam	3 Hours	40%	10/05 FN	20% CB & 20% OB

Announcements:

All notices in relation to above course will be put up only on the CMS notice board.
Students are advised to solve the relevant problems from Reference Books.

6. Mid-semester grading:

It will be announced normally in the month of March. It is done in the same manner as that of the final grading.

7. Make up policy:

Make up will be granted only in genuine cases. Permission must be taken in advance except in extreme cases.

8. Chamber consultation hours:

To be announced in class by the respective instructors.

Instructor In charge
MATH F113

Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2019-2020
Course Handout Part II

01-08-2019

In addition to part I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No.	**:**	MATH F211
Course Title	**:**	MATHEMATICS - III
Instructor-in-charge	**:**	Anil Nemili
Instructors	**:**	A Ramu, P.K. Sahoo, T.S.L. Radhika, K. Venkata Ratnam, Kishore Kumar, P T V Praveen Kumar, Jagan Mohan J, Santanu Koley, Nirman Ganguly, A Karthik, K. Panduranga, T Ranjan Panigrahi, Tusharakanta Pradhan

1. **Scopes and Objective of the Course:**
This Course reviews and continues with the study of differential equations with an objective to introduce classical methods for solving higher order ordinary differential equations, boundary value problems and partial differential equations. It also introduces an elegant method to solve some differential equations occurring in Mathematical Physics. Further, this course presents Fourier series and Laplace transform technique that finds applications in various branches of Engineering and Sciences. It also emphasizes the role of orthogonal polynomials in dealing with Sturm-Liouville problems.

2. **Text Book: Simmons** G. F., Differential Equations with Applications and Historical Notes, TMH, 2nd Edition, 2003.

Reference Book: **1.** Kreider D. L. and Others: An Introduction to Linear Analysis, A.W., 1966.
2. Shepley L. Ross: Differential Equations, John Willy & Sons, 1984.

3. **Course Plan:** (Sections- refer to Text Book)

Lecture No.	Learning Objectives	Topics to be covered	Chapter in the Text Book
1	To study methods for solving first order differential equations	Introduction to First order equations	1-7
2-4		First order equations	8-10
5		Reduction of order	11
6-7	To learn about second and higher order differential equations and various methods for solving them	Second order equations	14,15
8		Use of a known solution	16
9-12		Various methods to solve differential. equations	17-19,22,23

13-14	To understand the method of solving system of differential equations	Systems of Equations	54-56
	To study qualitative properties of solutions of differential equations	Sturm Separation Theorem and Sturm Comparison Theorem (Self study)	24, 25
15-16	To study an elegant method to solve higher order differential equations	Series Solutions	26-30
17-19		Hypergeometric equation	31
20-22	To learn about some special functions of Mathematical Physics	Legendre Polynomials	44,45
23		Chebyshev Polynomials	Appendix D
		Hermite Polynomials (Self-study)	Appendix B
24-27		Bessel functions	46,47
28-31	To study Laplace transform technique for solving differential and Integral Equations	Laplace Transforms	48-53
32-34	To learn trigonometric series expansion of discontinuous functions	Fourier Series	33-36
35-38	To learn methods to solve Boundary Value Problems	Eigen values and Eigen functions Sturm Liouville Problems	40, 43
39-42	To learn methods to solve linear partial differential equations	One dim. Wave equation, One dim. Heat equation, Laplace's equation	40, 41,42

4. Evaluation Scheme :

Evaluation Component	Duration	Weightage	Date & Time	Nature of Component
Assignment-1		10%	To be announced	Open book
Mid-Semester Test	90 min.	35%	28/9, 9.00 -- 10.30 AM	Closed book
Assignment-2		10%	To be announced	Open book
Compre. Exam.	3 hrs.	45%	2/12 FN	Closed book

Total Marks: 300

5. Make-up: Make up will be granted only in genuine cases in Mid-Semester Test. Permission must be taken in advance except in extreme cases.

6. Chamber consultation hour: To be announced in their class by the respective instructors.

7. Notices: All notices regarding MATH F211 will be put on CMS.

8. **Academic Honesty and Integrity Policy**: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable

Instructor-in-charge
MATH F211

Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2020-2021

Course Handout Part II

17-08-2020

In addition to part-I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No. : **MATH F212**
Course Name : **Optimization**
Instructor-in-charge: **Sumit Kumar Vishwakarma**
Instructor : P. K. Sahoo, P.T.V. Praveen Kumar and V. Venkata Hara Gopal.

1. **Scope and Objective of the Course:**

Engineers, scientists, analysts, and managers are often faced with the challenge of making trade-offs between different factors in order to achieve desirable outcomes. Optimization is the process of choosing these trade-offs in the best way. Optimization problems, having reached a degree of maturity over the past several years, are encountered in physical sciences, engineering, economics, industry, planning, and many other areas of human activity. The objective of the course is set to familiarize students with standard methods of solving optimization problems.

This course deals with details of various aspects associated with Optimization. These include a description of optimization techniques, namely, Linear Programming and Nonlinear Programming, and their applications to various engineering and science disciplines, including economics and finance. Multi-objective Optimization, which handles optimization aspects of more than one objective, is also discussed. A brief and informative description of Nontraditional optimization techniques such as Genetic Algorithms, Differential Evolution, Memetic Algorithms, Ant Colony Optimization, Particle Swarm Optimization, etc. is also provided.

2. Text Book:

T1 HA Taha, *Operations Research: An Introduction*, Pearson Education, 10/E, 2018.

Reference Books:

R1 SS Rao, *Engineering Optimization: Theory and Practice*, New Age International (P) Limited, Third Edition, 1996

R2 FS Hillier and GJ Lieberman, *Introduction to Operations Research*, TMH, 8/E, 2006.

R3 WL Winston, *Operations Research: Applications and Algorithms*, Thomson Learning, 4th Edition, 2004

R4 JC Pant, *Introduction to Optimization: Operations Research***,** Jain Brothers, New, 6/E, 2004.

R5 A Ravindran, DT Philips and JJ Solberg, *Operations Research: Principles and Practice*, John Wiley & Sons, Singapore, Second Edition, 1987

R6 GC Onwubolu and BV Babu, *New Optimization Techniques in Engineering*, Springer-Verlag, Heidelberg, Germany, First Edition, 2004.

3. Course Plan:

Lecture Nos.	Learning Objectives	Topics to be Covered	Ref. To Text book
1	Understand the concepts of Optimization. Learn basic optimization techniques	Introduction to Optimization	
2-4	Understand and develop Linear Programming models for mathematical problems	Two variable LP model, Graphical LP solution, Selected LP applications, Convex Set	T1 (2.1, 2,2, 2.4, 7.1)
5-6	Understand different techniques available for solving two, multivariate LP problems.	LP model in equation form, Transition from graphical to algebraic solution	T1 (3.1, 7.1.1 , 3.2)
7-9		The Simplex Method Generalized simplex tableau in matrix form, Revised Simplex Method.	T1(3.3., 7.1.2, 7.2)
10-12		Artificial starting solution Special cases in the simplex method	T1(3.4, 3.5)
13-14	Understand and solve special cases in the LP problems, introduce sensitivity analysis to re-evaluate a solution. Practical application of LP for solving real time problems	Definition of Dual Problem, Duality, Primal-Dual Relationships.	T1 (4.1, 7.4,4.2)
15-16		Economic Interpretation of Duality, Additional simplex algorithms (Dual Simplex Method, Generalized Simplex Algorithm),	T1(4.3, 4.4)
17-18		Post optimal Analysis	T1(4.5)
19-21	Understand special cases of simplex problems and its procedures.	Definition of transportation problem, The transportation Algorithm,	T1 (5.1, 5.3)
22		The Assignment Model	T1(5.4)
23-24	Understand multiple objective optimization problems and develop models for solving them	Goal Programming Formulation	T1 (8.1, 8.2)
25-26	Understand Integer Programming Problems and different techniques for solving IPP	Formulation of IP problem Branch and Bound method for solving IPP Cutting Plane method	T1 (9.1, 9.2)
27-28	Understand the difference between LPP and Nonlinear Programming Problems. Solve Nonlinear Programming Problems	Unconstrained problems, Convex and concave functions,	T1 (20.1)
29-30		Elimination Methods: Fibonacci Method and Golden Section Method,	R1 (5.7)

31-33 34-35 36-38		Gradient of a Function, Descent Methods: Steepest Descent Method and Conjugate Gradient Method, Karush-Kuhn-Tucker (KKT) Conditions, Quadratic Programming,	T1 (21.1.1) T1(21.1.2)R1(6.1 1,6.12) T1 (20.2.2) T1(21.2.2)
39-42	Introduce Evolutionary Computation Techniques	Drawbacks of the Classical Techniques, Introduction to Nontraditional Optimization Techniques (Genetic Algorithms, Differential Evolution, etc.)	R6

5. Evaluation Scheme:

Component	Weightage (%)	Duration (Minutes)	Date & Time	Nature of Component
Test 1	15	30	September 10 –September 20 (During scheduled class hour)	Open Book
Test 2	15	30	October 09 –October 20 (During scheduled class hour)	Open Book
Test 3	15	30	November 10 – November 20 (During scheduled class hour)	Open Book
Quizzes (2)	20	TBA	TBA	Open Book
Comprehensive Examination	35	120	TBA	Open Book

6. Notices: All notices about the course will be put on CMS.

7. Chamber Consultation Hour: To be announced in the class by the respective Instructors.

8. Make-up: Make up for the tests will normally be held in the following week. Make up will be Granted only in genuine cases. Permission must be taken in advance except in extreme cases.

9. **Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI- HYDERABAD CAMPUS
FIRST SEMESTER 2021-2022
Course Handout (Part II)

Date: 20.08.2021

In addition to the part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : MATH F214
Course Title : Elementary Real Analysis
Instructor in charge: MANISH KUMAR
Instructors: Manish Kumar, Nijjwal Karak

1. Scope and objective of the Course:

The objective of this course is to train the students with the essential tools of modern mathematical analysis, train them in the art of logical, deductive & constructive thinking and thus equip them with enough background for courses that involve more in-depth mathematical analysis. Real analysis is needed in several science & engineering disciplines, in the study of dynamical systems, which are solutions of differential equations, theoretical study of differential equations, the concept of fractal & fractal dimension is usually studied in metric spaces. Riemann integral is basic integral on which advance theory of integration is developed. Integration theory is needed in the study of theoretical & numerical solutions of partial differential equations.

2. Course Description: Countable and uncountable sets; real numbers, metric spaces, continuous and uniformly continuous maps in metric spaces, connectedness, completeness, and compactness in a metric space, Numerical sequences and series, Riemann integral & Riemann Stieltjes Integral, Convergence & uniform convergence of the Sequence of functions, Approximation of continuous function, functions of several variables, the derivative of a function of several variables, inverse function theorem.

3. Text Book:

W. Rudin, Principles of Mathematical Analysis, McGraw, Hill 3rd edition, 1976.

4. Reference Books:

1. R.G. Bartle and D.R. Sherbert, Introduction to Real Analysis, 4th Edition, John Wiley.
2. Apostal: Mathematical Analysis, Addison Wesley,1983.
3. Kenneth Ross: Elementary Analysis, Springer International Edition 2000.

5. Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
1-3	Representation of real numbers	Ordered field, Construction of real numbers, the set of real numbers as ordered field, extended real numbers	Chapter 1, Sec: 1.1 to 1.23
4-5	Difference between countable & uncountable set	Finite, Countable & uncountable sets	Chapter 2, Sec: 2.1 to 2.14
6-10	Generalization of the	Metric spaces, compact sets, different	Chapter 2, Sec:

	concept of distance to abstract sets	Definition of compact sets, Cantor Intersection theorem, Contraction Principle	2.15 to 2.47
11-14	A convergence of Sequence and series of real numbers	Sequence and infinite series	Chapter: 3
15-20	Generalization of concept of limit & continuity to metric spaces	Continuous & uniformly continuous functions& their properties	Chapter 4
21-28	Integration with respect to a function	Riemann Stieltjes integral & properties	Chapter 6
29-35	Distinguish between uniform & pointwise convergence of Sequence of functions. Functions not differentiable but continuous	Point & uniform convergence of functions & related properties of integrability & differentiability	Chapter 7 sec: 7.1 to 7.27
36-40	How continuity & differentiability have generalization for the function of several variables	Linear Transformations, Differentiation of functions of several variables	Chapter 9 sec: 9.1 to 9.15

6. Evaluation Scheme:

Components	Duration (Minutes)	Weightage* (%)	Date & Time	Nature of Component
Quiz 1	30 min	12.5%	To be announced later	Open Book
Mid Sem	90 min	35%	18/10/2021 9.00 - 10.30AM	Open Book
Quiz 2	30 min	12.5%	To be announced later	Open Book
Comprehensive Exam	120 min	40%	11/12 FN	Open Book

*The total marks of all the components, taken together will be 100.

7. Chamber consultation hour: To be announced in the class.
8. Notices: Notices concerning this course will be displayed on the CMS Notice Board only.
9. Makeup: Make-up will be given only for very genuine cases, and prior permission has to be obtained from the I/C.
Academic Honesty and Integrity Policy:
Academic honesty and integrity are to be maintained by all the students throughout the semester, and no type of academic dishonesty is acceptable.

INSTRUCTOR-IN-CHARGE
MATH F214

Birla Institute of Technology & Science, Pilani
Hyderabad Campus

INSTRUCTION DIVISION
FIRST/ SECOND SEMESTER 2016-2017
Course Handout Part II

Date: 01.08.2016

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : **MATH F215**
Course Title : **Algebra I**
Instructor-in-Charge : **Dr JAGANMOHAN JONNALAGADDA**

Scope and Objective of the Course: The objective of this course is to teach the importance of fundamental algebraic structures in modern mathematics and to relate the general results so obtained to concrete applications.

Text Book: I. N. Herstein, Topics in Algebra, 2nd Edition, John Wiley, 1975.

Reference Books:

1. Joseph A. Gallian, Contemporary Abstract Algebra, Seventh Edition, Brooks / Cole, Cengage Learning.
2. John B. Fraleigh, A First Course in Abstract Algebra, 3rd Edition, Narosa.
3. Dummit & Foote, Abstract Algebra, Third Edition, Wiley.
4. Jacobson H., Basic Algebra I, Feemass HPC, 1982.

Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
1 - 4	To understand the structural properties of different groups	Definition & Examples of Groups, Preliminary Lemmas	2.1 - 2.3
5 - 7		Subgroups, A Counting Principle	2.4, 2.5
8 - 10		Normal Subgroups & Quotient Groups	2.6
11 - 14		Homomorphisms, Automorphisms, Cayley's Theorem	2.7 - 2.9
15 - 18		Permutation Groups, Another Counting Principle	2.10, 2.11
19 - 22	To determine the existence of a simple group of a given order	Sylow's Theorems	2.12

23 - 24	To understand the structural properties of different rings	Definition & Examples of Rings, Ring of Real Quaternions	3.1, 3.2
25 - 26		Homomorphism & Examples	3.3
27 - 29		Ideals & Quotient Rings	3.4, 3.5
30 - 32		Field of Quotients of ID	3.6
33 - 35		Polynomial Rings, Polynomials over the Rational Field	3.9, 3.10
36 - 38		Unique Factorization Domain	3.11
39 - 40		Euclidean Rings	3.7
41 - 42		A Particular Euclidean Ring	3.8

Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Test I	1 Hr.	30	8/9, 11.30-12.30 PM	Closed Book
Test II	1 Hr.	30	25/10, 11.30-12.30 PM	Open Book
Comprehensive Exam.	3 Hrs.	40	07/12 AN	Closed Book

Chamber Consultation Hour: To be announced by the respective Instructor.

Notices: The notices concerning this course will be displayed in CMS only.

Make-up Policy: Make-up for tests will be given only for very genuine cases and prior permission has to be obtained from Instructor In-charge.

INSTRUCTOR-IN-CHARGE
MATH F215

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI- HYDERABAD
CAMPUS SECOND SEMESTER 2016-2017
INSTRUCTION DIVISION
COURSE HANDOUT (PART-II) 12-01-2017

In addition to part-I (General Handout for all courses appended to the time table) portion here give specific details about the course.

Course No. : **MATH F243**
Course Title : **Graphs & Networks**
Instructor-in-charge : **B. MISHRA**

1. Scope and Objective of the Course: The applications of graph theory are ranging from social sciences to electrical engineering and computer science to management. Every graph theoretic model is supported by a strong mathematical scheme. The objective of the course is, in addition to apply the graph theoretic model to different applications; students can develop a strong concept on the logical foundations, and can develop of a standard mathematical formulation for different real life problems.

2. Text Books:
Gary Chartrand & Ping Zhang : Introduction to Graph Theory , Tata Mcgraw-hill, Indian Edition 2006.

3. Reference Books:
R1: E. G. Goodaire & M. M. Parmenter : Discrete Mathematics with graph theory, 3rd edition, Pearson, 2002.
R2: Narsingh Deo: Graph theory with applications to engineering & computer science, PHI 1974.
R3: G. Agnarsson and R. Greenlaw : Graph Theory Modeling, Applications and Algorithms, Pearson, 2007.

4. Lecture Plan :

Lecture No.	Learners objective	Topic	Ref.
1-4	To introduce the concept of graph and its representation. Distinguish between multigraphs and digraphs.	Graphs and Graph Models, Connected Graphs, Classes of graphs, Multigraphs and Digraphs.	Chapter 1.1-1.4
5-8	Understanding the graph through the degree of the vertices. Relationship between the graphs and matrices.	Degree of a vertex, Regular graphs, Degree Sequence, Graphs and Matrices, Irregular graphs.	Chapter 2.1-2.5
9-12	To appreciate the concept of isomorphism as a concept of an equivalence relation on the set of all graphs.	Isomorphic Graphs, Definition of isomorphism, Isomorphism as a relation	Chapter 3.1-3.3
13-16	Concepts of distance between spanning trees, tree and rooted binary tree	Bridges, Trees, equivalent definitions, spanning tree, Minimal spanning tree, Prim's & Kruskal Algorithm Binary trees, Distance between spanning tree , eccentricity, Centre(s), diameter of tree & connected graph.	Chapter 4.1-4.4
17-20	How spanning tree is connected with concept of special type of cut set & circuit in a connected graph	Cut vertices, Blocks, Connectivity, Menger's Theorem	Chapter 5.1-5.4
21-23	To appreciate the difference between edge traversal & vertex traversal	Eulerian Graphs, Hamiltonian Graphs, Hamiltonian walk and numbers	Chapter 6.1-6.3
24-26	To determine the matching number, covering number.	Matchings, Factorization	Chapter 8.1-8.2

27-30	How simple concept of planarity of a graph is relevant to several problems.	Planar Graphs, Euler identity, Detection of planarity, Embedded graphs on surface. Graph Minors, Embedding graphs in graphs.	Chapter 9.1-9.4
31-34	How graph coloring problem is related to independent sets of graph, scheduling problems.	The four color problem, vertex coloring, edge coloring, chromatic number, chromatic partitioning, domination number.	Chapter 10.1-10.3 13.1
35-36	How concept of isomorphism is different in digraphs ,Difference between different type connected digraphs & spanning tree & directed spanning tree	Directed graph, Euler digraph, Isomorphism in digraph Strongly connected & weakly connected digraphs,	Chapter 7.1-7.2
37- 40	Directed weighted network, relevance of maximum flow	Network flow, Max Flow- Min Cut theorem, Fulkerson Algorithm for Maximum flow, Shortest path problem & Dijkstara Algorithm.	Chapter 14.1, 14.2, 10.4.1-10.4.3 (**R1)**

5. Evaluation Scheme:

Evaluation Component	Duration	Weightage	Date & Time	Remarks
Test-I	60 Minutes	20%	25/2, 8.30 - 9.30AM	Closed book
Test-II	60 Minutes	20%	3/4, 8.30 - 9.30AM	Closed book
Assignment(s)/Seminar		20%		Open book
Comprehensive	3 Hours	40%	10/05 AN	Both Closed Book and Open book

6. Notices: All notices about the course will be put on CMS/Mathematics Notice Board.

7. Chamber Consultation Hour: To be announced in the class.

8. Make-up: Make up will be granted only in genuine cases. Permission must be taken in advance.

Instructor-in-charge
MATH F243

Birla Institute of Technology & Science, Pilani
Hyderabad Campus

INSTRUCTION DIVISION
FIRST SEMESTER 2016-2017
Course Handout Part II

Date: 01-08-2016

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : *MATH F213*
Course Title : Discrete Mathematics
Instructor-in-Charge : P K Sahoo

Scope and Objective of the Course: Mathematics, described as a language of science, has acquired its unique position due to its precision and rigour. This makes essential the development of the sense for mathematical rigour as well as the habit of mathematical thought process. The course will achieve this by introducing the students to propositional and predicate logic. As an important follow-up, various methods of proof will be discussed. Several mathematical structures like relations and orderings are studied due to their importance, not only in mathematics but also applied subjects like computer science. The course is also useful to prepare for the study of computational study of concepts, techniques, and skills necessary to comprehend the structure of problems encountered in design and analysis of algorithms.

Textbooks:

1. Joe L. Mott, Abraham Kandel & Theodore P. Baker: Discrete Mathematics for Computer Scientist & Mathematicians PHI, 2nd Edition 2010.

Reference books

R1. KOLMAN, BUSBY & ROSS: Discrete Mathematical Structures, Pearson Education, 3rd Edition, 2007
R2. K H Rosen: Discrete Mathematics & its Applications, TMH, 6e, 2007.

Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
Self Study	To learn the basics that are needed for this course	Sets and Operations of sets, Relations and Functions	Chap 1, Sec:1.1 to 1.3
1-5	To learn the concepts of logic	Logic, logical inferences, methods of proof, Pigeonhole principle	Ch.1 sec. 1.5-1.7
6-10		First order logic & other methods of proof, quantifiers, Mathematical Induction, strong form of mathematical induction	Ch.1 sec.1.8-1.10
11-16	To learn the concepts of Permutations and Combinations	Elementary Combinatorics, Enumeration of Combinations and Permutations with repetitions and with constrained repetitions.	Ch.2
17-21	To learn recursive relations	Recurrence relations & solving recurrence relations with generating functions	Ch.3 sec.3.1-3.4
22-23		Method of characteristic roots for solving recurrence relations	Ch.3 sec.3.5
24-25		Solving inhomogeneous & nonlinear recurrence relations	Ch.3 sec.3.6
26-31	To learn the concept of relations and the connection between the directed graphs and relations	Relations & directed graphs, equivalence relations, partially ordered set, totally ordered set, Hasse diagrams, well ordered set, lattice theory	Ch.4 sec.4.1-4.4
32-35		Operations on Relations, paths and closures, adjacency matrices, Warshall's algorithm	Ch.4 sec. 4.5-4.7
36-40	To learn concepts Boolean algebra and its applications in circuits	Boolean Algebra, Boolean functions, switching circuits.	Ch.6 sec.6.1-6.5

Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Test I	1Hr.	30	10/9, 4.00--5.00 PM	Closed Book
Test II	1Hr.	30	22/10, 4.00--5.00 PM	Open Book
Compre. Exam	3 hrs	40	01/12 AN	Closed Book

Chamber Consultation Hour: To be announced in class
Notices: All notices related to the course will be put up on the notice board of the Mathematics department.
Make-up Policy: Prior permission needed for make-up.

INSTRUCTOR-IN-CHARGE

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
HYDERABAD CAMPUS
INSTRUCTION DIVISION
SECOND SEMESTER 2016 - 2017
Course Handout Part II

12-01-2017

In addition to Part - I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No. : **MATH F241**
Course Title : **Mathematical Methods**
Instructor-in-charge : **Dr JAGANMOHAN JONNALAGADDA**

1. Scope and Objective of the Course:

This course introduces different mathematical methods and their applications to many real life problems of science, engineering and technology.

2. Text Books:

T1: F. B. Hildebrand, Methods of Applied Mathematics, Dover Publications, Second Edition, 1992.
T2: Sudhakar Nair**,** Advanced Topics in Applied Mathematics: For Engineering and the Physical Sciences, Cambridge University Press, 2011.

Reference Books:

R1: G. B. Arfken and H. J. Weber, Mathematical Methods for Physicist, Academic Press 2002.
R2. Anadi S. Gupta, Calculus of Variations with Applications, Prentice - Hall of India Pvt. Limited, 2004.
R3. Lokenath Debnath and D. Bhatta, Integral Transform and their Applications, Taylor & Francis, 2002.
R4. Ivar Stakgold, Michael J. Holst, Green's Functions and Boundary Value Problems, Wiley, 3rd Edition, 2011.
R5. R P. Kanwal, Linear Integral Equations, Birkhauser Boston, 1996.

4. Lecture Plan:

Lecture No.	Learning Objectives	Topics to be covered	Text Book/Sec.
1 - 2	To deal with the formulation and theory of linear integral equations	**Integral Equations:** Introduction and relation between integral and differential equations.	**T1 (3.1 - 3.2)**
3 - 5	To introduce and interpret Green's function	Green's operator and Green's function, adjoint operator, Sturm - Liouville operator.	**T1 (3.3)**
6 - 12	To study different analytical procedures available for the exact solution of certain linear integral equations	Classification of integral equations, Fredholm equations, Hilbert - Schmidt theory, Iterative methods for solving equations of the second kind, the Neumann series and Fredholm theory.	**T1 (3.6 - 3.11)**
13 - 16	To describe various numerical methods for obtaining approximate solutions of certain linear integral equations	Approximation of Fredholm equations by set of algebraic equations, approximate methods by undetermined coefficients, method of collocation, method of weighing function, method of least squares.	**T1 (3.15 - 3.19)**

17 - 18	To introduce a powerful technique for solving linear and partial differential equations arising in engineering and physics when the domain is infinite or semi-infinite	Dirac - Delta function and its properties. Fourier series, Riemann - Lebesgue lemma, localization lemma, Fourier integral theorem, Fourier cosine and sine transforms.	**T2 Chapter I (Articles 1 - 10), T2 (3.1 - 3.4)**
19 – 21	To discuss important properties of Fourier transforms	Properties of Fourier transforms, properties of trigonometric transforms, transforms of elementary functions.	**T2 (3.5 - 3.7)**
22 - 26	To illustrate some examples of solutions of differential and integral equations obtained using the Fourier transform	Convolution integral, mixed trigonometric transform, Applications of Fourier transforms, discrete Fourier transform.	**T2 (3.8 - 3.9, 3.11, 3.18)**
27 - 31	To introduce the variational notation and derive the Euler equations relevant to a large class of problems	**Calculus of Variations:** Maxima and minima, The simplest case, illustrative examples**,** natural boundary conditions, transition conditions, the variational notation, general case of two independent variables.	**T1 (2.1 - 2.6)**
32 - 33	To determine one or more functions by a variational procedure in which variations are governed by one or more auxiliary conditions.	Constraints and Lagrange's multipliers.	**T1 (2.7)**
34	To solve variational problems in which the boundary of the region of integration is not completely specified but is to be determined together with the unknown function or functions.	Variable end points.	**T1 (2.8)**
35 - 38	To illustrate one of the important class of variational problems	Sturm - Liouville problems, Hamilton's principle, Lagrange's equations.	**T1 (2.9 – 2.11)**
39 - 40	To obtain approximate solutions of problems expressed in variational form	The Rayleigh - Ritz method.	**T1 (2.19)**

5. Evaluation Scheme:

S. No.	Evaluation Component	Duration	Weightage (%)	Date & Time	Nature of Component
1	Test I	1Hour	30	23/02, 8.30 - 9.30 AM	Closed Book
2	Test II	1Hour	30	04/04, 8.30 - 9.30 AM	Open Book
3	Comprehensive Exam.	3Hours	40	08/05 FN	Closed Book

7. **Make-up Policy**: Make-up for tests will be given only for very genuine cases and prior permission has to be obtained from Instructor In-charge.

8. **Chamber consultation hour:** To be announced by the respective Instructor.

9. **Notices:** The notices concerning this course will be displayed in CMS only.

Instructor In-charge
MATH F241

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI

SECOND SEMESTER 2017-2018

Course Handout Part II

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : **MATH F242**
Course Title : **OPERATIONS RESERACH**
Instructor-in-charge : **DK SATPATHI**

1. **Scopes and Objective of the Course:**

This course begins with applications overview of Operations Research, and introduces dynamic programming and network models. After a review of probability distributions, inventory models and queuing systems will be covered. Decision- making under certainty, risk, and uncertainty; along with an introduction to game theory will be dealt. Finally simulation techniques, introduction for estimating solutions to problems, that are not amenable to conventional solution techniques, will be made. Students will also be taught the basic concepts on system reliability.

2. Text Book:

1. Hamdy A Taha, "Operations Research: An Introduction", Pearson Education, Ninth Edition, 2012.
2. Venkateswaran S and B. Singh, "Operations Research" EDD Notes.Vol.3, 1997.

.

3. Reference:

1. Hillier and Lieberman, "Introduction to Operations Research", T M H, Eighth Edition, 2006.
2. Bernard W. Taylor, "Introduction to Management Science 8e", Prentice hall
3. Anderson, Sweeney and Williams, "Quantitative methods for business 8e", Thomson South Western.
4. Ayyub, B.M. and McCuen R.H., "Probability, Statistics and Reliability for Engineers and Scientists", Chapman & Hall 2e, 2003.

4. Lecture Plan

Lecture Nos.	Learning Objectives	Topics to be Covered	Chapter in the Text Book
1	Introduction to Operations Research	Introduction, Historical Development, Impact of O.R., Phases of O.R., Overview of O.R., Modeling Approach	Chapter 1 (T1)
2-4	Review of Basic Probability	Random variables, Binomial, Poisson, Exponential and Normal Distribution	Chapter 14 (T1)
5-13	Introduce Queueing Systems	Definition, Birth and Death process, Role of Exponential Distribution, Generalized Poisson Queueing Models, Specialized Poisson Queues.	Chapter 7 (T2)

14- 19	When to produce / purchase and how much	Deterministic and Probabilistic Inventory Models	Chapter 8 (T2)
20-24	How to solve complex system and basic concept of simulation	Introduction, Generation of random variates from different distributions, Simulation of Single-server queueing model and inventory model.	Chapter 9 (T2)
25-29	To under stand the basic concept of Reliability	Basic concepts, Hazard rate function, Reliability of the systems, failure time distributions.	Chapter 6 (T2)
30- 33	Learn about Decision analysis and Game theory	Decision analysis under uncertainty and Game Theory	Chapter 15 (T1)
34-37	To understand dynamic programming	Deterministic Dynamic Programming,	Chapter 12 (T1)
38-42	Learn basic concepts Network Models	Definition, Minimal Spanning tree Algorithm, Shortest route Problem, CPM and PERT	Chapter 6 (T1)

5 .Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Mid-Semester Test	90 mts	35	6/3 9.00-10.30 AM	Closed Book
Announced Quizzes	15 mts	10	There will be 3 announced (announced in the previous lecture class) quizzes which will be conducted at the last 15 mts of some of the lecture/tutorial classes. Out of 3, best 2 will be chosen. No makeup will be granted for this component	Closed book
Seminar		10		
Comprehensive Examination	3 hours	45	03/05 FN	2 hours Closed book and 1 hour Open book

6. Make-Up Policy: Only genuine cases will be entertained.

7. Chamber Consultation Hours: To be announced in the class.

8. Notice: Notices concerning this course will be displayed on CMS /Mathematics Notice Board.

INSTRUCTOR-IN-CHARGE

Birla Institute of Technology & Science, Pilani
Hyderabad Campus

INSTRUCTION DIVISION
SECOND SEMESTER 2016-2017
Course Handout Part II

12-01-2017

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : MATH F244
Course Title : Measure and Integration
Instructor-in-Charge : MANISH KUMAR

1.Scope and Objective of the Course: The objective of this course is to give a comprehensive and sound introduction to Lebesgue measure theory and integration. The concepts of several notions of convergence and convergence theorems are also covered in this course. The classical theory of Reimann integration has some obvious draw backs: Firstly, the class of Reimann integrable functions is relatively small and secondly the limiting operations often lead to insurmountable difficulties. In this courses the students will be taught how these problems are overcome in the case of Lebesgue measure theory.

2.Textbooks:

1. 1. P.K. Jain, V.P. Gupta, P. Jain, *Lebesgue Measure And Integration*, New Age International Ltd, Delhi, 2nd ed., 2011.

3.Reference books

1. 1. G. de Barra, *Measure Theory and integration*, New Age International Ltd, Delhi, 2003.
2. 2. H. L. Royden, *Real Analysis*, Prentice Hall, 2005.
3. 3. Inder Kumar Rana : *Introduction to Measure & Integration*, Narosa, Delhi 1997.

4.Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book

1-3	To make the students understand that it is impossible to define a measure for all subsets of real numbers and introducing the concepts of measurable sets	Length of an interval, Outer measure, Lebesgue measure	Chapter 3, Sec: 3.1 to 3.3
4 – 7	To study the properties of Measurable sets	Properties of measurable sets, Borel sets and their measurability, Characterization of measurable sets.	Chapter 3, Sec: 3.4 to 3.7
8	To prove the existence of Non-measurable sets	Non-measurable sets	Chapter 3, Sec:3.8
9 – 15	To study the concept of measurable functions	Definition and Properties of measurable functions, Operations on measurable functions, Step function, continuous function, Set of measure zero, Borel measurable function; Characteristic and Simple functions	Chapter 4, Sec:4.1 to 4.9
16 – 21	To study the almost everywhere concept and the different notions of convergence of sequence of functions	Sequence of functions, The structure of measurable functions, almost everywhere convergence and convergence in measure	Chapter 4 Sec: 4.11 to 4.12
22 – 34	To study the Lebesgue Integral	Lebesgue integral of a bounded function and its properties, Comparison of Riemann and Lebesgue integrals, Integrals of a Nonnegative measurable functions, General Lebesgue integrals, Improper Integrals	Chapter 5 Sec: 5.2 to 5.7
35 – 40	To study the relationship between Integration	Dini Derivatives, Differentiation of monotone functions, Functions of	Chapter 6, Sec: 6.1 to 6.4 &

	and Differentiation	bounded variation, Differentiation of an integral, Absolute continuity	Sec: 6.6

5.Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Test 1	1 hour	30 %	23/2, 1.00 - 2.00 PM	Closed Book
Test 2	1 hour	30%	4/4, 1.00 - 2.00 PM	Open Book
Comprehensive Examination	3 hours	40%	03/05 AN	Closed Book

6.Chamber Consultation Hour: To be announced in the class.

7.Notices: All notices concerning this course will be displayed in CMS/Mathematics Notice Board.

8.Make-up Policy: Makeup will be given only for very genuine cases and prior permission has to be obtained from I/C.

INSTRUCTOR-IN-CHARGE

Birla Institute of Technology & Science, Pilani
Hyderabad Campus

INSTRUCTION DIVISION
FIRST SEMESTER 2017-2018
Course Handout (Part II)

01-08-2017

In addition to part-I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No. **:** MATH F311
Course Title : INTRODUCTION TO TOPOLOGY
Instructor-in-charge : SHARAN GOPAL

Scope and Objective of the Course: A general objective is to introduce the students to concepts of logical thinking in abstract terms using formal and axiomatic methods and to lay the foundations for further studies in abstract mathematics. Specifically, this course on topology is aimed at making the students familiar with most of the basic topological concepts that are used in almost every branch of advanced mathematics courses.

Text Book: Munkres, J.R.: Topology, PHI (Second Edition), 2000

Reference Books:

1. John L. Kelley, General topology., van Nostrand. Reprinted (1976) by Springer Verlag
2. L. A. Steen and J. A. Seebach, Counterexamples in topology, Springer, 1978.

Course Plan:

Lecture No.	Learning Objectives	Topics to be covered	Sec. No. of Text Book
1	To give the overview of the course and give the broad perspective of the course	Overview of the course	-
2 - 3	To make the students understand the definition of topological spaces and the how it generalizes the concept of metric spaces	Topological Spaces; Examples	12
4	To study the concept of basis and understand how it generates a topology	Basis and subbasis	13

5	To study the topology which is defined using an order relation on a set	The order Topology	14
6	To study the subspace topology	Subspaces & Subspace Topology	16
7	To study the product topology for product of finitely many topological spaces	Finite Products	15
8 – 10	To study the topological properties of subsets of a topological space	Closed sets, closure and Interior of a set, limit points, Hausdorff spaces	17
11 – 13	To study the continuous functions and homeomorphisms on a topological space	Continuous functions; homeomorphisms	18
14 – 15	To study the two different concepts of product topology on arbitrary product of topological spaces and understand why do we prefer product topology to box topology	Product Topology and Box Topology	19
16 – 19	To study the metrizable topological spaces and their properties	Metric topology	20-21
20 – 22	To study the quotient topology and understand how this concept is connected with geometry	Quotient topology	22
23 – 25	To study the concept of connectedness for a topological spaces and understand how a topological space can be broken into pieces that are connected	Connected Spaces, Components and Local connectedness	23-25
26 – 28	To study the various notions of compactness in a topological spaces	Compact Spaces	26-28
29 – 30	To study the notion of local compactness	Locally Compact spaces	29
31 – 33	To study the countability axioms and understand how hw countability axioms are well behaved with respect to the operations of taking subspaces or countable products	Countability axioms	30
34 – 36	To study the separations axioms and their properties	Separation axioms	31
37 – 38	To study the normal topological spaces	Normal spaces; Urysohn's lemma	32-33
39 – 40	To study a theorem that gives us conditions under which a topological space is metrizable	Urysohn Metrization Theorem	34

41 – 42	To study the arbitrary product of compact spaces	Tychonoff's Theorem	37

Evaluation Scheme:

EC No.	Evaluation Component	Duration	Weightage	Date, Time	Nature of Component
1.	Quiz 1	Will be announced in the class	5%	Will be announced in the class	Closed Book
2.	Assignment 1	--	10%	Will be announced in the class	Open Book
3.	Mid-Semester Test	90 min	30%	12/10 3.30 -- 5.00 PM	Closed Book
4.	Quiz 2	Will be announced in the class	5%	Will be announced in the class	Closed Book
5.	Assignment 2	--	10%	Will be announced in the class	Open Book
6.	Comprehensive Examination	3 hrs	40%	09/12 AN	Closed Book

Make-up Policy: No make-up will be given for quizzes and assignments. For other components, make-up will be given only for very genuine cases and prior permission has to be obtained from the IC.

Chamber consultation hours: To be announced in the class.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable

Notices: The notices concerning this course will be displayed on the CMS site only.

Instructor-in-charge
MATH F311

Birla Institute of Technology & Science, Pilani
Hyderabad Campus

INSTRUCTION DIVISION
FIRST SEMESTER 2017 - 2018
Course Handout Part II

01-08-2017

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : *MATH F312*
Course Title : *Ordinary Differential Equations*
Instructor-in-Charge : ***Dr. J. Jagan Mohan***

Scope and Objective of the Course:
Ordinary Differential Equations frequently occurs as mathematical models in many branches of science, engineering and economy. For a mathematician confronted with such a model there are a number of issues to address and various approaches to choose from:
Is the problem well posed? Do you expect the differential equation to have a solution? If so, is there a unique solution satisfying the given initial or boundary conditions?
Can you find an explicit analytical solution? This is only possible in rare circumstances.
Geometric or qualitative methods: These methods give insights into general, qualitative features of solutions and do not require solving the differential equation.
Stability and dependence on parameters: Having obtained a solution by any method, we would like to know how the solution changes if we change the initial data by a small amount (stability analysis) and if we change parameters in the differential equation (parameter dependence). Course helps deeper understanding of the complicated models that are there in the real life.

Textbooks:

1. **S Ahmad & M R M Rao**: Theory of Ordinary Differential Equations with Applications in Biology and Engineering, East West Press, 1999.

Reference books

1. The Qualitative Theory of Ordinary Differential Equations - An Introduction, Fred Brauer and John A Nohel, Dover Publications.
2. Stability Theory of Differential Equations, Richard Bellman, Dover Publications.**3**
3. Theory of Ordinary Differential Equations, E A Coddington & N Levinson, Tata Mc Graw - Hill Publications.
4. Differential Equations and Dynamical Systems, Lawrence Perko, Springer.

Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book

1 - 2	Know the basic definitions and notations	Introduction and Overview of the Course, Notation and Definitions	Chapter 1 Sections 1 - 2
3 - 8	Learn the existence and uniqueness theorems for scalar equations and for a general system of equations	Existence and Uniqueness of Solutions of Scalar Differential Equations, Existence Theorems for System of Equations, Differential and Integral Inequalities	Chapter 1 Sections 3 – 5
9 -16	Understand the properties of linear systems	Introduction to Linear Systems, FSS, Properties of Linear Homogeneous Systems, Inhomogeneous Linear Systems	Chapter 2 Sections 1 – 3
17 - 21	Learn how to find the behavior of linear equations of higher order	Behavior of Solutions of *n*th order Linear Homogeneous Equations, Asymptotic Behavior	Chapter 2 Sections 4 – 5
22 - 24	Understand the concept of stability of a linear system	Introduction to Stability, Continuous Dependence and Stability Properties of Solutions	Chapter 3 Sections 1 – 2
25 - 33	Learn the stability analysis of weakly non-linear and 2-D systems	Linear Systems, Weakly Nonlinear Systems, Two Dimensional Systems	Chapter 3 Sections 3 – 5
34 - 38	Learn the Liapunov method for stability analysis	Introduction to Stability by Liapunov Second Method, Autonomous Systems, Non - Autonomous Systems	Chapter 5 Sections 1 – 3
39 - 42	Understanding more about the behavior of solutions of second order equations	Second Order Differential Equations, Boundedness of Solutions, Oscillatory Equations, Classical Equations	Chapter 4 Sections 1 - 5

Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Mid Semester Test	90 Min.	30	12/10 9.00 -- 10.30 AM	Closed
Comprehensive Examination	180 Min.	40	08/12 FN	Closed
Quiz	40 Min.	10	To Be Announced	Closed
Assignment	-	20	To Be Announced	Open

Chamber Consultation Hour: To be announced in the class.
Notices: All notices regarding MATH F312 will be displayed on CMS
Make-up Policy: Make up of other evaluation components will be granted only in genuine cases. Permission must be taken in advance except in extreme cases.
Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable

INSTRUCTOR-IN-CHARGE

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI

FIRST SEMESTER, 2019-2020

Course Handout (Part II)

01-08-2019

In addition to part I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. **: MATH F313**
Course Title **: Numerical Analysis**
Instructor-in-charge **: A RAMU**
Instructors **: A RAMU and Nirman Ganguly**

1.Scope and Objective of the Course:

Enables one to devise algorithms for the numerical solutions of mathematical problems. Also discusses the error analysis of different algorithms.

2.Text Book: Applied Numerical Analysis by Curtis F. Gerald, Patrich O. Wheatley Pearson education (7th Edition) 2003.

3. Reference Books: 1. Numerical Analysis, Burden and Faires, 7th ed., Thomson Learning, 2001

2. Elementary numerical Analysis, SD Conte & Carl de Boor 3rd ed., TMH 2006 (Reprint).

4. Course Plan:

Lec. No.	Learner's Objective	Topic to be Covered	Chapter in the Text Book
1-3	To understand the potential pitfalls of numerical computing	Introduction, Using computer to do numerical analysis, Errors, Sources of errors, Floating point arithmetic, Arithmetic accuracy in computer, Significant digits, Relative error, Propagation of errors, how to avoid loss of significant digits, evaluation of polynomial, Parallel and distributed computing	0.1-0.7
4-9	To find roots of nonlinear equations and understand the relative strengths and Weaknesses of each Computation. Learn to apply.	Bisection, secant, false –position, Newton's method, Muller's method, Fixed point iteration method. Order of convergence, multiple roots.	1.1-1.6
10-15	To solve a linear system, using gaussian elimination and iterative methods and compute matrix inverse and understand the relative strengths and weakness of each computational method. Learn to apply.	The Elimination method, Gaussian Elimination, Other direct methods, Pathology in linear systems-singular matrices, Determinants and matrix inversions, Tridiagonal systems, Thomas algorithm, Norms, condition numbers and errors in computed solutions; Jacobi's method, Gauss Seidel method, SOR method , Newton's methods, fixed-point methods for non-linear systems	2.1-2.6, 1.7
16-21	What is an interpolating polynomial and how to efficiently evaluate it. Learn to apply.	Existence and Uniqueness of interpolating polynomial, Lagrange polynomials Divided differences, Evenly space points, Error of interpolation, cubic spline, Inverse interpolation	3.1, 3.2-3.3, 12.10(R1)

22-28	To compute numerical derivatives and integration using discrete data points and know how to integrate functions Learn to apply.	Derivatives from difference table, Higher order derivatives, Extrapolation techniques, Newton-Cotes Integration formulas, The Trapeziodal rule- a composite formula, Simpsons rule, Other ways to derive integration formulas, Gaussian Quadrature,	5.1-5.3, 5.6, 14.11-14.12(R1)
29-34	To compute numerical solutions of initial value problem Learn to apply. s.	The Taylor Series method, Euler and Modified Euler's method, Runge-kutta Methods Multistep methods : Milne's method, Adams-moulton method, Predictor – corrector formulas, system of equations and higher order equations,	6.1-6.6
35-37	Understand boundary value problems the solution methodology	The shooting method, Finite difference method, solution through a set of equations, Derivatives boundary conditions	6.7, 16.4(R1)
38-39	Learn the iterative way. Learn to apply.	Power method, Inverse Power method & QR methods of finding eigenvalues and eigenvectors of matrices	6.8
40-42	Introduction to Finite element Methods and some solutions methods.	The Rayleigh-Ritz method, The Collocation and Galerkin Methods, Finite Elements for Ordinary-Differential equations	9.1-9.2

5. **Evaluation Scheme:**

Components	**Duration**	**Wt%**	**Date&Time**	**Nature of Component**
Quiz-5		10	to be announced	closed book
Mid Sem	90 mnts	30	28/9, 11.00 -- 12.30 PM	closed book
Assignment		20		open book
Compre Exam	3 hrs	40	2/12 AN	closed book

6. Problems: Students are strongly advised to work out all the relevant problems in the text-book and do similar problems from the reference books. It is also recommended that the students should try out the algorithms on computers (Using MATLAB) to get a better understanding of the subject.

7. Chamber Consultation Hours: To be announced in the class.

8. Make-up: Make-up for any component of evaluation will be given only in genuine cases of absence.

9 Notices: All notices related to this course will be put only on the Mathematics Department Notice Board.

10. **Academic Honesty and Integrity Policy**: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-In-Charge
MATH F313

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE-PILANI, HYDERABAD CAMPUS
INSTRUCTION DIVISION
SECOND SEMESTER 2014-2015
Course Handout (Part II)

Date: 02-12-2015

In addition to Part I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : **MATH F341**
Course Title : **INTRODUCTION TO FUNCTIONAL ANALYSIS**
Instructor-in-Charge: **Debdas Ghosh**

1. Scope and Objective of the Course:

Objective of the course is to present basic facts of Functional Analysis in a form that is suitable for Engineers, Scientists and Mathematicians. Ideas are not always generated through logical processes. An engineer may have a feeling for a problem which may lead to a method of solution but justifying part of that needs Analysis. Several concepts of Functional Analysis were invented as there was need from Integral and Differential Equations. Functional Analysis is also needed in Numerical Analysis and Optimization Theory. Modern theory of partial differential equations also relies heavily on the tools of functional analysis.

2. Course Description:

Normed linear spaces, Banach spaces, continuous linear transformations, open mapping theorem, closed graph theorem, uniform boundedness principle, Hahn-Banach theorem, Hilbert spaces, dual space, direct sum and orthogonal complement in Hilbert spaces, function spaces, Symmetric and self adjoint linear mapping in Hilbert spaces, finite rank and compact transformations, unbounded linear transformation, spectral theory, differential equations and linear transformations

3. Text-book: Erwin Kreyszig, *Introductory Functional Analysis with Applications*, Reprinted 2010, John Wiley

4.. Reference Books:

(i) Fabian et al, Functional Analysis and infinite-dimensional geometry, Springer (2001)
(ii) B.V. Limaye, *Functional Analysis*, New Age International Ltd. (1996)
(iii) George F. Simmons, *Introduction to Topology and Modern Analysis*, Tata McGraw Hill (2004)

5. Course Plan:

Lecture no.	Learner's objective	Subject matter	Reference
1-3	Recollect some concept of linear Algebra and real Analysis	Vector spaces, dimension, finite dimensional vector spaces, Metric spaces, space of continuous functions	Chapter 1 & Chapter 2: Sec 2.1
4	Introduction to normed linear spaces and Banach spaces	Normed Linear Spaces, Banach spaces and examples such as l_p, c, c_0, $C[a,b]$	Chapter 2 : Sec 2.2
5-7	Studying properties of normed linear spaces	Properties of normed linear spaces	Chapter 2 : Sec 2.3
8-9	All norms are equivalent on a finite dimensional normed linear space	Finite-Dimensional normed linear spaces and compact sets	Chapter 2: Sec 2.4 and 2.5

10-13	Studying continuity of linear transformations on normed linear spaces	Continuous linear transformations, linear functionals, dual spaces, reflexivity	Chapter 2: Sec 2.6 to 2.10
14-20	How concept of dot product has generalization to certain vector spaces	Inner product spaces, Hilbert spaces, orthogonal sets, direct sum, Bessel's inequality, continuous linear functionals on Hilbert space	Chapter 3: Sec 3.1 to 3.7
21-23	Dual of a Hilbert space, how transpose of a matrix has generalization to continuous linear transformations in Hilbert spaces	Riesz Representation theorem, Symmetric and self adjoint operators	Chapter 3: Sec 3.8 to 3.10
24	How a continuous linear functional defined on a subspace can be extended to whole space	Hahn-Banach Theorem	Chapter 4 Sec 4.2
25-30	When a family of Continuous linear transformations uniformly bounded, When is a continuous linear map a homeomorphism ,closed linear maps need not be bounded	Category theorem ,uniform boundedness principle, strong and weak convergence, Open Mapping theorem, Closed graph theorem	Chapter 4: Sec 4.7 to 4.13
31 - 33	Are there finite rank transformations defined on infinite dimensional spaces	Compact linear operators and their spectral properties	Chapter 8: Sec 8.1 to 8.3
34-36	Integral equations & compact linear transformations	Banach fixed point theorem , Integral equations	Chapter 5 : Sec 5.1 to 5.4
37-40	Generalization of eigen values of matrices to linear transformations	Spectral theory of bounded linear transformations	Chapter 7 : Sec 7.1 to 7.3

6. Evaluation Scheme:

Components	Durations	Weightage	Date & Time	Remarks
Test I	1 Hour	20%		Closed Book
Test II	1 Hour	20%		Closed Book
Assignments	-	20%	Details will be announced in the class	Open Book
Comprehensive Exam	3 Hours	40%		Closed Book

7. Make up Policy: Make-up will be given only for very genuine cases and prior permission has to be obtained from I/C.

8. Chamber consultation hours: To be announced in class.

9 Notices: The notices concerning this course will be displayed on the CMS Notice Board only.

INSTRUCTOR-IN-CHARGE
MATH F341

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI,
HYDERABAD CAMPUS
INSTRUCTION DIVISION, SECOND SEMESTER 20152016
Course Handout Part II

Date: 12.01.2016

In addition to part I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. **: MATH F342**
Course Title **: DIFFERENTIAL GEOMETRY**
Instructorincharge **: B. MISHRA**

1. **Scope and Objective of the Course:**

The objective of this course is to provide a systematic exposition of the essential concepts of modern differential geometry, and an understanding and appreciation for the intrinsic beauty of these concepts, as well as their deep relationships to computer and physical Sciences. The under current is to generalize and reinforce the classical subject in a modern way.

2. **Text Book:** Andrew Pressley: Elementary Differential Geometry, Springer (India), 2001.

Reference Books:

1. Vaisman A First course in Differential geometry Marcel Dekker Inc. (1984).
2. Barrett O'Neill – Elementary differential geometry, 2/E, A Harcourt Science and Technology Company (1997).
3. Gray – Modern differential geometry of curves and surfaces with MATHEMATICA, 2/E, CRC Press (1999).
4. Struik D. J. –Lectures on classical differential geometry, 2/E, Dover Publications (1988) Reprint.

3. Course Plan:

	Topics to be covered	No.of Lect.	Chapter in the Text Book
1.	Curves in the plane and in space.	4	Chapter 1
2.	How much does a curve curve?	4	Chapter 2
3.	Global properties of curves	3	Chapter 3
4.	Surfaces in 3-dimensions	5	Chapter 4
5.	First Fundamental Form	3	Chapter 5(5.1 - 5.3)
6.	Curvature of Surfaces	5	Chapter 6
7.	Gaussian Curvature	6	Chapter 7
8.	Gauss's Theorema Egregium	5	Chapter 10

9.	Geodesics	5	Chapter 8
	Total	40	

4. **Evaluation Scheme:**

Component	Duration	Weightage(%)	Date & Time	Remarks
Test I	1 Hour	20	27/2, 8.30 - 9.30AM	Closed Book
Test II	1 Hour	20	11/4, 8.30 - 9.30AM	Closed Book
Assignment / Presentation	To be announced in the class	20		Open Book
Comprehensive Exam	3 Hours	40	16/05 AN	Closed Book

5. Chamber consultation Hour: To be announced in the class.

6. Notice: Notice, if any, concerning this course will be displayed only in CMS.

7. Make up: Prior permission is needed for make up; make up will only be given if enough evidence is there for not being able to take regular test.

Instructorincharge
MATH F342

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI-Hyderabad Campus
INSTRUCTION DIVISION, SECOND SEMESTER 2015-2016
Course Handout (Part II)

Dated: 12/01/2016

In addition to Part-I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course Number : MATH F343
Course Title : Partial Differential Equations
Instructor : Dr. T S L Radhika

1.Course Description

Non linear equations of first order, Charpit's Method, Method of Characteristics; Elliptic, parabolic and hyperbolic partial differential equations of order 2, maximum principle, Duhamel's principle, Green's function, Laplace transform & Fourier transform technique, solutions satisfying given conditions, partial differential equations in engineering & science.

2.Scope and Objectives

Enables one to understand the nature of partial differential equations, find solutions to these equations along with some applications in the field of Science and Engineering.

3.Textbook

1. Tyn Myint-U and Lokenath Debnath, Linear Partial Differential Equations for Scientists and Engineers, Birkhauser, 4th Edition.

4.Reference Book(s)

1. Ian N. Sneddon, Elements of Partial Differential Equations, International Series in Pure and Applied Mathematics.
2. Walter A. Strauss, Partial Differential Equations, An introduction, John Wiley & Sons
3. T. Amarnath, An Elementary Course in Partial Differential Equations, Narosa Publishing House, 2nd Edition.
4. K. Sankara Rao, Introduction to Partial Differential Equations, PHI Learning Private Limited, 3rd Edition.

5.Course Plan

Lec.No.	Topics to be covered	Learning Objectives	Chapter in the Text Book
1-2	Introduction of Partial differential equations	Motivation for studying partial differential equations	1.1-1.6
3-4	Introduction, First order linear equations	Introduction and overview of first order partial differential equations	2.1-2.4
5-8	Methods of Characteristics, Canonical Form, Method of Separation of variables, Charpit's Method, Jacobi Method	Geometrical interpretation of first order PDEs, Canonical form of first order linear equations, To Find solutions of first order PDEs	2.5-2.7, R1-2.10-2.14
9	Second order equations in two variables	Introduction of second order partial differential equations	4.1

10-11	Canonical Form	To convert the second order differential equations into the standard form Characterization of 2nd order PDE's and its solutions	4.2
12-13	Equations with constant Coefficients		4.3, R1-3.4
14	General solution	Difference between general solution of ODEs and PDEs	4.4
15-21	Wave equation	Solution of Homogeneous and inhomogeneous wave equations, D'Almbert Principle, Duhamel Principle, Spherical and cylindrical wave equations	5.1-5.2, 5.3-5.6, 5.10-5.11
22-26	Maximum-minimum principles	To obtain the maximum and the minimum of solutions of PDEs	9.1-9.9
27-29	Laplace Equation	Solution of Laplace equations in different domains with homogeneous boundary condition	10.1-10.4
30-32	Heat and Wave Equations	Analysis and behavior of solutions of heat and wave equations in two and three dimensions	10.5-10.9
33-36	Green's Functions	Solution of PDEs in terms of Green's functions	11.1-11.5
37-38	Fourier Transform	Use of Fourier techniques in finding the solutions of PDEs	12.2-12.11
39-40	Laplace Transform	Use of Laplace techniques in finding the solutions of PDEs	12.8-12.10

6.Evaluation Scheme:

ECNo.	Evaluation Component	Duration	Weightage %	Date	Nature of Component
1	Test-I	1 hr	20	26/2, 10.00 - 11.00 AM	Closed Book
2	Test-II	1 hr	20	12/4, 10.00 - 11.00 AM	Open Book
3	Assignments , Presentations		20		Open Book
4	Comprehensive Exam	3 hr	40	05/05 FN	Closed Book

7.Notices: All notices about the course will be put only on CMS.

8.**Chamber Consultation Hour:** To be announced in the class.

9.**Make UP Policy**:

(i) NO MAKE UP will be given in Assignment and Presentation components under any circumstances.

(ii) Make up of other evaluation components will be granted only in genuine cases. Permission must be taken in advance except in extreme cases.
(iii) No MAKE-MAKE-UP will be entertained.

Instructor-In-Charge
MATH F343

Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER, 2022 - 2023
Course Handout Part II

29-08-2022

In addition to Part-I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No. : MATH F231
Course Title: Number Theory
Instructor In-charge: Rohit Gupta

Scope and Objective of the Course:
In this course we cover the basic mathematical notation and methods which include mathematical induction, properties of divisors, prime numbers, integer functions, equations in integers and the applications of some of the concepts. The main objective of this course is to understand the divisibility properties of integers and other related topics as a basis for studying more advanced topics in Number Theory, Modern Algebra, and the number theoretic cryptography algorithms.

1. Text Book:
Thomas Koshy: Elementary Number Theory with Applications, Second Edition, Academic Press, 2007.

2. Reference Books:
(i) Kenneth H. Rosen: Elementary Number Theory and its Applications, Addison – Wesley publishing Company, 1986.
(ii) Neal Koblitz: A Course in Number Theory and Cryptography, 2nd Edition, Springer, 1994.
(iii) Tom M. Apostol: Introduction to Analytic Number theory, Springer, 1976.

3. Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
1	To explain the fundamental properties of integers	Fundamental properties, the summation and product notations, mathematical induction, recursion, the binomial theorem	1.1 – 1.5
2 – 3	To examine the correctness of a division problem	The division algorithm	2.1
4 – 6	To classify the various classes of positive integers	Prime numbers, composite numbers, Fibonacci numbers, Lucas numbers, Fermat numbers	2.5 – 2.7
7	To list the fundamental operations on integers	Greatest common divisor	3.1
8 – 9	To know how to find the greatest common divisor of two numbers having prime factorizations.	The Euclidean algorithm	3.2
10	To know how to factorize any positive integer	The fundamental theorem of arithmetic	3.3
11 – 13	To learn linear Diophantine equations	Least common multiple, linear Diophantine equations	3.4 – 3.5
14-16	To define what is congruence and explain their fundamental properties	congruence, linear congruence, the Pollard Rho factoring method	4.1 – 4.3
17 – 22	To explain the four classical mile stone theorems in number theory	Chinese remainder theorem, Wilson's theorem, Fermat's little theorem, Euler's theorem	6.1 – 6.3, 7.1, 7.2, 7.4
23 – 26	To define the multiplicative functions and to explain their properties	Euler's phi function, the tau and sigma functions, the Mobius function	8.1 – 8.2, 8.5
27 – 29	To explain perfect numbers	Perfect numbers, Mersenne primes	8.3 – 8.4
30 – 33	To define the order of an integer and primitive roots	The order of a positive integer, primality tests, primitive roots for primes	10.1 – 10.3
34 – 38	To define quadratic residues and to explain the famous law of quadratic reciprocity	Quadratic residues, the Legendre symbol, quadratic reciprocity, the Jacobi symbol,	11.1 – 11.4
39 – 40	To explain the continued fractions	Finite continued fractions, infinite continued fractions	12.1 – 12.2

4. **Evaluation Scheme:**

ECNo.	Evaluation Component	Duration	Weightage (%)	Date	Nature of Component
1.	Quiz-I	To be announced later	10	To be announced later	**Open Book**
2.	Mid Semester Exam	90 min.	35	02/11 9.00 - 10.30AM	**Closed Book**
3.	Quiz-II	To be announced later	10	To be announced later	**Open Book**
4.	Comprehensive Exam	180 min.	45	22/12 FN	**Closed Book**

Total marks: 200

5. **Chamber consultation hour:** Will be announced in the class.

6. **Notices:** The notices concerning this course will be displayed in CMS.

7. **Make-up Policy**: Make-up for tests will be given only for very genuine cases and prior permission has to be obtained from Instructor In-charge.

8. Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor In-charge

MATH F231

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
HYDERABAD CAMPUS
SECOND SEMESTER 2016-2017
COURSE HANDOUT (Part II)

12-01-2017

In addition to Part I (General Handout for all courses appended to the time table) portion here give specific details regarding the course.

Course Number : **MATH F353**
Course Title : **Statistical Inference and Applications**
Instructor-In charge : **P.T.V. PRAVEEN KUMAR**

1. **Scope and objective of the course:**
   The goal of statistical inference is to study data with the intention of infering knowledge that goes beyond the immediate scope of the data. One usually focusses on two kinds of inferences: Estimation and testing of hypothesis. More specifically, the course deals with some of the statistical techniques of decision making. Both parametric and non-parametric methods will be discussed. Comparisons of two treatments is discussed, several treatments using analysis of variance is dealt with. Control charts for measurements and attributes will be discussed.
2. **Text Books:**
   Venkateswaran, S., & B. Singh, Operations Research, Notes-EDD, Vol.1 and 2, 1997.
3. **Reference Books:**
   1. Devore JL, Probability and Statistics for Engineering and the Sciences, 5th ed., Thomson, 2000
   2. Johnson, R.A.: Miller Freund's Probability and Statistics for engineers, 8th. Ed., PHI, 2005.
   3. Vijay K. Rohatgi: Statistical Inference: Dover Publications, Inc. New York, 2003.
4. **Lecture Plan:**

Lecture	Learning Objectives	Topics to be covered	Chapter in the Text Book

1-6	Probability theory makes predictions about experiments whose outcomes depend upon chance. Consequently, it lends itself beautifully to the use of computers as a mathematical tool to simulate and analyse experiments. Students will learn the theory,methods and practice of forming Judgements about the parameter of population and the reliability of statistical relationships, typically on the basis of random sampling. Students will learn the concepot of likelihood ratios and the concept of Hypothesis testing, possible coming of errors, power of the test ,Best Critical Regions and Uniformaly Most powerful Critical regions ,Generalised likelihood ratio tests.	Review of Elements of Probability Theory and Statistical Concepts.	Chapter 1
6-7		Classification of hypotheses as simple and composite, Distributional and parametric hypotheses. Examples	2.1 to 2.2
8-9		Hypothesis testing in General Terminology	2.3 to 2.4
10-11		Neymann Pearson's lemma, BCR (Simple vs. Simple hypotheses)	2.5,2.5.1
12-13		UMPCR (Simple vs composite, composite vs composite). Monotone likelihood ratio and its application.	2.5.2-2.5.3
14-15		GLRT (No derivation of GLRT need to be discussed. One example of derivation of GLRT, given in the book may be explained.) Use of various tests based on GLRT without derivation.	2.6
16	Students will learn to compare Parametric tests and Non parametric tests. Students learn to investigate the cause of	Approximate tests, paired t-test (Omit the derivations of GLRT but the results to be applied to numerical problems)	2.7

17	rejection of the hypothesis in multiple comparison procedures. Identify the multiple applications where non parametric approaches are appropriate.	Testing of hypotheses about multinomial probabilities.	2.8
18-19		Applications of the test in lect.1 (above) to distributional hypotheses and the resulting Chi-Square test of goodness of fit.	3.2,3.3
20-21		Kolmogorov-Smirnov one sample test.	3.4
22-24		Chi-Square test for independence and homogeneity	3.5,3.6
25		Wilcoxon's test	3.7,3.8,3.8.2
26-28		Sign test, Signed rank-sum test	3.9,3.9.1,3.9.2
29-32	Students learn the use of Analysis of Variance(ANOVA-one way, Two Way Classifications) when there are more than two inpendent popululations means to be compared. They learn basic experimental designs (CRD, RBD, and LSD).	Introduction and one-way classification (Fixed Effects Model)	4.1,4.2
32-35		Randomized Block Design for one and classification, two-way classification (one observation per cell-interaction absent.)	4.3,4.3.1,4.3.3 and 4.4
36-37		Latin Square Design and missing values	4.5,4.6
38-39		Test for testing the equality of variances	4.7

5. Evaluation Scheme:

EC No.	Evaluation Component	Duration	Max Marks	Date & Time	Remarks
1	TEST 1	1 hour	20%	28/2, 11.30 -12.30 PM	Closed Book
2	TEST 2	1hour	20%	31/3, 11.30 -12.30 PM	Closed Book
3	Assignment/Seminars (R- software to be used)	--	20%		Open Book
3	COMPRE	3 Hours	40%	04/05 AN	Closed Book

Announcements:

All notices in relation to above course will be put up on the notice board of Mathematics Department/CMS.

6. **Mid-semester grading:**
   It will be announced normally in the month of March. It is done in the same manner as that of the final grading.
7. **Make up policy:**

   Make up will be granted only in genuine cases. Permission must be taken in advance except in extreme cases.

8. **Chamber consultation hours:** Will be announced in the class.

Instructor In charge
MATH F353

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI- HYDERABAD CAMPUS
FIRST SEMESTER 2021-2022
COURSE HANDOUT (PART-II)

29-08-2022

In addition to part I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. **: MATH F456** .
Course Title **: Cosmology**
Instructorincharge **: P K SAHOO**
Instructor :

1. **Scope and Objective of the Course:**

This course will serve as an introduction to Cosmology, which is a fascinating branch of science and deals with large scale structure of the Universe as a whole, in particular the origin, evolution and ultimate fate of the Universe. In this course, we shall introduce the fundamentals of modern cosmology via the Mathematics of Newtonian Mechanics starting with the observational overview of the Universe. With the derivation of necessary equations governing the evolution of Universe, we will motivate and analyse the basic mathematical models of the Universe. The remainder of the course will be devoted to explain and understand the observed features of the Universe by extending the basic mathematical models, where we will discuss topics such as cosmic acceleration, cosmological constant, cosmic microwave background, inflation and nucleosynthesis in early Universe.

2. **Text Book:** A. Liddle: An Introduction to Modern Cosmology, Relativity and Cosmology, 3rd edition,Wiley (2015).

3. Reference Books:

R1. S. Weinberg, Gravitation and Cosmology, John Wiley, New York, (1972).

R2. M. Rowan-Robinson, Cosmology, 3rd edition, Oxford University Press (1996).

R3: J. A. Peacock: Cosmological Physics, Cambridge University Press (1999).

4.Course Plan: (Sections/Articles refer to Text Book)

Lect No.	Learning Objectives	Topics to be covered	Chapter in the Text Book
1	Introduction	Brief history of cosmological ideas	Chapter 1
2-5	Observational overview of the Universe	In visible light, In other wavebands, Homogeneity and isotropy, The expansion of the Universe, Particles in the Universe	2.1-2.5
6-8	Newtonian Gravity and basic equations of the Universe	The Friedman equation, Meaning of the expansion, Things that go faster than light, The fluid equation, The acceleration equation, Mass, energy and vanishing factors of c2	3.1-3.6
9,10	The geometry of the Universe	Flat, Spherical and Hyperbolic geometries, Infinite and observable Universes, Place of Big Bang, Three values of k	4.1-4.6

11-13	Simple cosmological models	Hubble's law, Expansion and redshift, Matter, Radiation, Mixtures, Particle number densities, Evolution including Curvature	5.1-5.5
14,15	Observational parameters	Hubble parameter, Density parameter, Deceleration parameter	6.1-6.3
16,17	Cosmological constant and age of the Universe	Cosmological constant, Fluid description, Cosmological models with cosmological constant, Age of the Universe	7.1-7.3 Chapter 8
18-21	Density of Universe and dark matter	Weighing the Universe through counting stars, nucleosynthesis, galaxy rotation curves, galaxy cluster composition, bulk motions, formation of structure, brightness of supernovae, Nature of dark matter and its searches	9.1-9.3
22-24	Cosmic microwave background	Properties of the microwave background, photon to baryon ratio, origin of microwave background	10.1-10.4
25-27	Early Universe and nucleosynthesis	The early Universe, Hydrogen and Helium, Comparing with observations, Contrasting decoupling and nucleosynthesis	Chapter 11 12.1-12.3
28-32	Inflationay Universe	Problems with Hot Big Bang: Flatness, horizon and relic particle abundances, Inflationary expansion, Solution of Big Bang problems, Extent of inflation, Inflation and particle physics	13.1-13.5
33, 34	Initial ingularity and the overview of standard cosmological model	The initial singularity, Overview of the standard cosmological model	Chapter 14 Chapter 15
35-40	Advanced topics	General relativistic cosmology, Distances and luminosities, Structures in the Universe	Advanced topics 1-2,5

5. Evaluation Scheme:

Evaluation Component	Duration	Weightage	Date & Time	Nature of Component
Quiz 1	30 min	10%		Open Book
Seminar		10%		Open Book
Midsemester	90 min	30%	04/11 3.30 - 5.00PM	Closed Book
Quiz 2	30 min	10%		Open Book
Compre. Exam	3Hr.	40%	28/12 AN	Closed Book

Birla Institute of Technology & Science, Pilani
Hyderabad Campus

INSTRUCTION DIVISION
SECOND SEMESTER 2016-2017
Course Handout Part II

Date: 12-01-2017

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course Number : CS F111
Course Title : Computer Programming
Instructor-In-Charge : Dr.Aruna Malapati
Team Members: Prof.Tathagata Ray,Mr.Surender Singh Samanth,Mr.Sanjeev Singh

Scope and Objective of the Course:
The course covers the following topics: Basic Model of a Computer; Problem Solving – Basic Computing Steps and Flow Charting (Assignment, Sequencing, Conditionals, Iteration). Programming Constructs – Expressions, Statements, Conditionals, Iterators/Loops, Functions/Procedures; Data Types – Primitive Types, Tuples, Choices (Unions or Enumerations), Lists/Arrays, Pointers and Dynamically Allocated Data. Input output and Files.
While the topics are taught using a specific language, the intent of the course is to teach a programming methodology, and not a programming language. There is also a laboratory component that involves development and testing of iterative and procedural programs using bounded and unbounded iterations, function composition, random access lists, sequential access lists, dynamically allocated lists, and file access. Finally, sincerely putting effort will reward you making you a good problem solver which is very much required in every sphere of life and course.

The primary goals of the course are to introduce:

- Basic representation of data and how to process data using the representation inside a computer.
- Techniques for specifying data, operations on data, and problem solving using C.
- Systematic techniques and approaches for constructing programs.

Text and Reference:
T1. J.R. Hanly and E.B. Koffman, *Problem Solving and Program Design in C*. 7th Edition. Pearson Education
Reference Books:
R1. Programming with C Bryon Gottfried, Jitendra Chhabra TMH 3rd Edition.
R3. Brian W. Kernighan, Dennis Ritchie. *The C Programming Language*. Prentice Hall. 2nd Edition.
R4. Yale Patt, Sanjay Patel. *Introduction to Computing Systems: From bits & gates to C & beyond*, Second edition, McGraw Hill.

Course Plan

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
1	To list computer hardware and computer software	Introduction to computers, programming, high level languages, compiling programs, integrated development environments	T1 (Chap 1) R1 (Chap 1)
2	To solve problems and formulate solutions to computing problems To be able to apply and use correct symbols for flowcharting given a problem	Problem statement, input/output description, the notion of an algorithm, algorithm development, flow charts	T1 (Chap 1) R1(Chap 1)
3-12	To be able to demonstrate the use of operators and data types in writing C expressions. To be able to represent data in different numbers systems and perform conversions.	C language elements: variables, data types and sizes, operators, expressions, precedence and associativity, general form of a C program, Number systems and Data Representation	T1 (Chap 2) R1 (Chap 2, 3) R2 (Chap 2, 4) R4(Chap 2)
13-14	To be able to demonstrate and apply the formatted input output statements.	How printf(), scanf() works and field widths and precisions ?	T1 (Chap 2) R1(Chap 4) R3(Chap 3)
15-16	To be able to demonstrate and apply the C programming language constructs and solve problems.	C statements and blocks, Making decisions: if-else, else-if, switch construct	T1(Chap 4) R1(Chap 6) R2(Chap 5)
17-19		while, do-while, for, break and continue, goto and labels	T1(Chap 5) R1(Chap 6) R2(Chap 6)
20-22	To be able to write programs using functions and comprehend the various types of parameter passing and also passing different data types.	Functions and program structure, arguments and local variables, function prototype, function definition, calling functions, returning function results, simple example of recursion.	T1(Chap 6) R1(Chap 7)
23-26	To be able to write programs using arrays for searching and sorting	Declaring and referencing arrays, using array elements as counters, initializing arrays, 1-D and 2-D arrays, passing arrays to functions, Searching and Sorting	T1(Chap 7) R1(Chap 9) R2(Chap 8, 9)
27-28	To be able to use and write programs using pointers efficiently	Pointer variable declaration and initialization, pointer operators, pointers and addresses, pointer arithmetic, pointer arrays, pointer to a function, call by reference	T1(Chap 6) R1(Chap 11) R2(Chap 11, 12, 17)
29-30	To be able to use and write programs using strings and its library functions efficiently	String basics, string library functions, string comparison, null string	T1(Chap 8) R1(Chap 10) R2(Chap 13)
31-33	To be able to use and write programs using structures and Enums efficiently	Basics of structures, unions and enums, structure type data as input and output, array of structures, structure containing structures, pointers to structures, Self-referential structures. Difference between structures and unions	T1(Chap 10) R1(Chap 12) R2(Chap 16)

34-35	To be able to distinguish between different storage classes TO be able to use the right storage classes while writing programs	Memory segment of a C program in RAM and Different storage classes: auto, register static and external.	T1(Chap 12) R2(Chap 18)
36-37	To understand bit-level manipulations	Bitwise operators, bit-fields, shift function, rotating bits	R1(Chap 14) R2(Chap 20)
38-40	To implement Linked-List in C	Creation, traversal, search, insertion, deletion in the linked list	T1(Chap 13) Lectures Notes
41-42	To be implement file processing for persistent data storage	Files and streams, creating and accessing sequential files, random access files, read, write operations, binary files	T1(Chap 11) R1(Chap 13) R2(Chap 22)

Evaluation Scheme: [Legends: OB - Open Book, CB - Closed Book]

Component	Duration	Weightage(%)	Date & Time	Nature of Component
Test-1	60 Mins	15%	27/2, 4.00 - 5 .00 PM	Closed Book
Test-2	60 Mins	15%	1/4, 4.00 - 5 .00 PM	Closed Book
Quiz		5%		Open Book
Lab Evaluation*		35%		Open Book
Comprehensive	3 hrs.	30%	08/05 AN	Open Book

***Lab Evaluation[35%]**

- Continuous Lab Evaluation – 10%
- Online Test-1 – 10%
- Online Test-2 – 15%

  Open Book: CMS, Text Book, Lab Sheets, Tutorial Sheets

Chamber(B226) Consultation Hours: Tuesday 4-5 PM

Course Notices:

All notices pertaining to this course will be displayed on the CS&IS Dept. Notice Board and/or CMS.

MAKE UP POLICY

- ***No Make-ups for Quizzes and lab evaluations.***
- Prior Permission of the Instructor-in-Charge is required to get make-up for the Test-1/Test-2. Only on producing documentary proof of possible absence, which proves that student would be physically unable to appear for the test/exam, the decision of granting the make-up will be taken.
- Prior Permission of Dean, Instruction Division is required to get make-up for the comprehensive exam.
- Instructor-in-charge's / Dean's decision in the matter of granting Make-up would be final.

Instructor-In-Charge, CS F111

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI,
HYDERABAD CAMPUS
INSTRUCTION DIVISION, FIRST SEMESTER 2017-18
COURSE HANDOUT (PART-II)

Date :

In addition to Part I (General Handout for all the courses appended to the time table), this portion gives further specific details regarding the course.

Course No.	**CS / EEE / ECE / INSTR F215**
Course Title	**Digital Design**
Instructor-in-charge	**BVVSN Prabhakar Rao**
Team of Instructors	
Lecture	BVVSN Prabhakar Rao, Souvik Kundu
Tutorial	BVVSN Prabhakar Rao, Souvik Kundu, Soumya J
Practical	BVVSN Prabhakar Rao, Souvik Kundu, Soumya J, Michael Preetam Raj, J. Sravan Kumar
Course Description	This course covers the topics on logic circuits and minimization, Combinational and sequential logic circuits, Programmable Logic devices, State table and state diagrams, Digital ICs, Arithmetic operations and algorithms, Introduction to Computer organization, Algorithmic State Machines
Scope and Objective	The objective of the course is to impart knowledge of the basic tools for the design of digital circuits and to provide methods and procedures suitable for a variety of digital design applications. The course also introduces fundamental concepts of computer organization. The course also provides laboratory practice using MSI devices.

Text Books:

T1: M.Moris Mano and Michael D. Ciletti " Digital Design", PHI, 5th Edition, 2013
T2: G Raghurama, TSB Sudharshan "Introduction to Computer Organization". EDD notes 2007
T3: Laboratory Manual for Digital Electronics and Computer Organization.

Reference Books:

R1: Donald D. Givonne, "Digital Principles and Design" TMH, 2003.
R2: Samir Palnitkar, "Verilog HDL", Prentice Hall; 2 edition, 2003

Course Plan

Lect. No.	Learning Objectives	Topics to be covered	Reference to Text Book
1	Introduction to Digital Systems and Characteristics of Digital ICs.	Digital Systems, Digital ICs	1.1, 1.9, 2.3, 10.1 & 10.2
2-3	Boolean algebra and logic gates, Codes number systems	Boolean functions, Canonical forms, number systems and codes	1.2 - 1.7, 2.4-2.9
4 - 5	Simplification of Boolean functions	K-Maps (4,5 variables)	3.1- 3.8
6	Simulation and synthesis basics	Hardware Description Language	3.11
7	Simplification of Boolean functions	QM Method	3.10
8-10	Combinational Logic, Arithmetic circuits	Adders, Subtractors, Multipliers	4.1 – 4.7
11-12	MSI Components	Comparators, Decoders, Encoders, MUXs, DEMUXs	4.8 - 4.11
13	Simulation of Combinational Logic Functions.	HDL for Combinational Logic	4.12
14-15	Sequential Logic	Flip-Flops & Characteristic tables, Latches	5.1 - 5.4
16-18	Clocked Sequential Circuits	Analysis of clocked sequential circuits, state diagram and reduction	5.5, 5.7 & 5.8
19-20	Registers & Counters	Shift registers, Synchronous & Asynchronous counters	6.1 - 6.5
21	Simulation of Sequential Logic Functions.	HDL for Sequential Logic	5.6
22-23	Analysis of arithmetic units	Multiplication & Division algorithms	T2: Appendix A & Class Notes
24-27	Modular approach for CPU Design	RTL, HDL description	8.1 & 8.2, 8.4 - 8.8
28-30	Design of Digital Systems	Algorithmic State Machines	R1. Chapter 8
31-33	Design of Asynchronous Circuits.	Asynchronous Sequential Logic	9.1 – 9.4
34-36	Memory and PLDs	RAM, ROM, PLA, PAL	7.2, 7.5 - 7.7
37-39	Memory Organization	Memory Hierarchy & different types of memories	T2: Ch 6 & Class Notes
40-42	Digital Integrated Circuits	TTL, MOS Logic families and their characteristics	10.3, 10.5, 10.7 - 10.10

Lab Experiments

S.No	Experiment	Reference
1	Familiarization of Bench Equipment	A complete Lab Manual is available on CMS and also one hard-copy in the Digital Design Lab
2	Implementation of Boolean Functions using Logic Gates	
3	Write Verilog code at gate level and verify (i) 3-input majority function using AND – OR logic gates (ii) even – odd parity generation (iii) Binary – Gray code conversion	
4	Adders and Subtractors	
5	Write Verilog code at gate level and verify (i) 1-bit full adder and (ii) 4-bit full adder using (a) instantiation and (b) Test bench	
6	BCD Adder	
7	Write Verilog code for (i) 1-bit full adder and (ii) 4-bit full adder using data-flow modeling	
8	Decoders, Multiplexers and Demultiplexers	
9	Comparators & Arithmetic Logic Unit	
10	(i) Latches & Flip- Flops (ii) Write Verilog code for implementing various flip-flops	
11	(i) Counters (ii) Write Verilog code for implementing counters	
12	Shift Registers	

General Instructions for Lab

1. There will be an observation book of 100 pages (white)
2. After every lab, observation book must be signed by Faculty/Research Scholar
3. Lab carries 20% weightage.
   - (i) 10% Day to Day evaluation (including attendance) and
   - (ii) 10% Final Lab Examination
4. Only one makeup will be allowed

Evaluation Scheme:

Component	Duration	Weightage (%) and Marks	Date & Time	Nature of Component
Midsem Test	1 ½ Hour	25% (75)	9/10, 11 – 12.30 pm	Closed Book
Quizzes (2)	----	15% (45)	To be announced	Open Book
LAB component	Day to Day Evaluation	10% (30)	Regular	Demo/Practicals/ (Open Book)
	LAB Exam	10% (30)	To be announced	Closed Book
Comprehensive Exam	3 Hours	40% (120)	01/12, AN	Closed Book
TOTAL		100% (300)		

Make-up Policy: There will no make-ups unless for genuine reasons. Prior Permission of the Instructor-in-Charge is required to take a make-up for any component.

Chamber Consultation Hour: To be announced in class.

Notices: All notices shall be displayed only on the **EEE/ECE Notice Board / CMS.**

Dr. BVVSN Prabhakar Rao
Instructor-in-charge
(CS/EEE/ECE/INSTR F215)

Birla Institute of Technology & Science, Pilani
Hyderabad Campus
Instruction Division
Second Semester 2015-2016
Course Handout (Part-II)

12-01-2016

In addition to Part I (General Handout for all courses appended to the Time Table), this portion gives further specific details regarding the course.

Course No. **: CS/ECE/EEE/INSTR F241**
Course Title : Microprocessor Programming & Interfacing
Instructor-in-charge : Runa Kumari
Team of Instructors : Subha Mada, Soumya J , Ananth Saradhi, M K Kaushik, P Spandana, Pavan Kumar Reddy .

Course Description : 8086 - 80486 Programmers model of processor, processor architecture; Instruction set, modular assembly programming using subroutines, macros etc.; Timing diagrams ; Concept of interrupts: hardware & software interrupts, Interrupt handling techniques, Interrupt controllers; Types of Memory & memory interfacing; Programmable Peripheral devices and I/O Interfacing ; DMA controller and its interfacing: Design of processor based system.

Text Book:

T1: Barry B Brey, The Intel Microprocessors .Pearson, Eight Ed. 2009.

Reference book:

R1: Douglas V Hall, Microprocessor and Interfacing, TMH, Second Edition.

Detailed Course Plan:

Lect. No.	Learning Objectives	Topics to be covered	Chapter in the Text Book
1.	Introduction to Microprocessor and Microcomputers	Compute Architecture, Memory & I/O organization, CISC/RISC processors	Chapter 1 (T1), Chapter 1 (R1)
2-3	Microprocessor & its architecture	8086 Microprocessor	Chapter 2 (T1), Chapter 2 (R1)
4-6	Assembly Programming	Addressing Modes	Chapter 3 (T1)
7-12	Assembly Programming	Instruction Set & ALP	Chapter 4-6, 8 (T1)
13-15	8086/8088 Hardware	Pin Out, Modes of operation,	Chapter 9 (T1)

	Specifications	Clocking, Buses	
16-19	Memory Interface	Memory Devices, Address Decoding- Mmeory Interface 8086- 80386	Chapter -10 (T1)
20-23	I/O Interfacing	Basic I/O interfacing (I/O mapped I/O and Memory mapped I/O) I/O port address decoding	11.1, 11.2 (T1)
24-26	Interrupts	Types of interrupts, Vector tables, Priority Schemes	12.1, 12.2, (T1)
27-29	Programmable Peripheral Devices	8255,8254,ADC,DAC, 8259	11.3-11.6 & 12.3 -12.6 (T1)
30-31	DMA controller	8Basic Operation, 8237, Shared Bud, Disk Memory Systems, Video Displays	Chapter -13 (T1)
32-33	Bus Interface	ISA, PCI, Com, USB,AGP	Chapter 15 (T1)
34-36	Advanced Processors	80186-80286	Chapter 16 (T1), Chapter 15 (R1)
37-39	Advanced Processors	80386-80486	Chapter 17 (T1), Chapter 15 (R1)

Evaluation Scheme:

EC No	Evaluation Component	Duration	Weightage	Marks	Date & Time	Nature of Component
1.	Test-I	60 min	15%	45	29/2, 4.00 - 5 .00 PM	Closed Book
2.	Test-II	60 min	15%	45	9/4, 4.00 - 5 .00 PM	Open Book
3.	Surprise Quiz	15 min each	10%	30		Closed Book
4.	Lab	2hrs/week	20%	60		Open book
7.	Comprehensive examination	180 min	40%	120	12/05 AN	Open Book
	Totals		100%	300		

Note: No make-up for surprise quiz.
Chamber Consultation Hour: Will be announced in the class.

Notices: Notices concerning to this course will be on CMS.

Runa Kumari
Instructor-in-Charge

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
INSTRUCTION DIVISION
FIRST SEMESTER 2017-2018

Course Handout (Part - II)

Date: 02/08/2017

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. **: BITS F343**
Course Title **: FUZZY LOGIC & APPLICATIONS**
Instructor-in-charge **: CHANDRA SHEKHAR**

1. **Scope and objective of the course:**

The aim of this course is two fold: 1. to provide a thorough understanding of the basics of this topic which has important applications in almost all fields of study; 2. to bring the students face-to-face with an application in some important area. To this end, every student is required to work on a project, as part of the course, involving an application of Fuzzy Logic (preferably in the students own discipline). The nature of the project could be study oriented, or computer-oriented, or simulation of a system or design of a working model etc. (The scope of the project is limited only by the student's imagination, creativity, and vision). Further, the project work provides an opportunity to the students to study Research Articles / Papers appearing in various journals and learn about the latest developments in the applications of Fuzzy Logic.

2. **Text Book:** M. Ganesh: Introduction to Fuzzy Sets and Fuzzy Logic, PHI, (2006)

Reference Books:

R1 George. J. Klir & Bo Yuan: Fuzzy Sets and Fuzzy Logic, PHI, 1997.
R2 Timothy J. Ross:- Fuzzy Logic with Engineering Applications, John Wiley & Sons, 2004.
R3 R. Kruse et al.: Foundations of Fuzzy Systems, John Wiley & Sons, 1994.
R4 J. Yen & R. Langari: Fuzzy Logic: Intelligence, Info. & Control, Pearson (2001)
R5 Kwang H. Lee: First Course on Fuzzy Theory and Applications: Springer International Edition (2005).
R6 D. K. Pratihar: Soft Computing: Narosa (2008).
R7 S.N. Sivanandam and S.N.Deepa: Principles of Soft Computing: Wiley India, Second Edition (2011).

3. **Course Plan:**

Learning Objectives	Topics to be covered	Lectures	Ref. to Text Book
Basics of crisp and fuzzy set and their properties	Crisp set Theory	1	Chap. 1
	Fuzzy Set Theory	2-9	Chap. 6
Introduction of fuzzy number and its applications	Fuzzy Numbers	10-13	R1
To understand how fuzzy theory is useful in relation, logic, reasoning and their applications	Fuzzy Relations	14-16	Chap. 7
	Propositional Logic & Predicate Logic	17-20	Chap. 2 & 3
	Fuzzy Logic, Fuzzy reasoning	21-25	Chap. 8
	Switching Functions & Boolean Algebra	26-30	Chap. 4 & 5
How the fuzzy theory is applicable for real life problem	Applications of Fuzzy Logic	31-34	Chap. 9 & 10, Project
	Fuzzy Probability	35-37	R5
To obtain understanding of neural network	Fundamentals of Neural Networks	38-40	R6

4. **Home & Reading Assignments:** Problems assigned in the class must be worked out. Students are expected to read relevant portions of the reference books and other books available in the library. Further, they must read all relevant articles and papers appeared/appearing in various Journals.

5. **Evaluation scheme:**

Component	Duration	Weightage (%)	Date & Time	Remarks
Mid Semester	90 minutes	35	13/10 2:00 - 3:30 PM	CB
Assignment/Project/Presentation	----------	20	To be announced	Partly OB
Comprehensive	180 minutes	45	12/12 FN	Partly OB

6. **Chamber Consultation Hour:** To be announced in the class.

7. **Notices:** Notices concerning the course will be displayed on Mathematics Department notice board and NALANDA.

Instructor-In-Charge

Birla Institute of Technology & Science, Hyderabad Campus
Instruction Division
First Semester, 2016-2017
Course Handout (Part II)

Date:

In addition to Part I (General Handout for all courses appended to the Time Table), this portion gives further specific details regarding the course.

Course No. : EEE F435 / ECE F435

Course Title: Digital Image Processing

Instructor – in - Charge: Sumit K Chatterjee
Instructors: Sumit K Chatterjee and R. Venkateswaran

Course Description: This is a first course on digital image processing. It begins with an introduction to the fundamentals of digital images and discusses the various discrete transforms, which are extensively used in image processing. It then goes on to discuss the different image processing techniques such as image enhancement, automatic image classification and recognition.

Scope & Objective: The course introduces the students to the fundamentals of digital images and various processing techniques that are applied to them so as to improve their quality. These techniques are image enhancement, automatic image classification and recognition.

Text Book: Gonzalez, R. C. & R. E. Woods, Digital Image Processing, Pearson Education, 3rd ed., 2009

Reference Books:

1. Digital Image Processing using MATLAB, Gonzalez, Woods & Eddins, Pearson, 2007

Course Plan:

Lecture No.	Learning Objectives	Topics to be covered	Reference to Text Book
1	To introduce fundamental concepts and terms associated with digital images.	Introduction and digital image fundamentals.	Chap 2
2-3	To study image enhancement by gray level transformations	Some basic gray level transformations	Sec. 3.1, 3.2
4-6	To study Histogram processing of an image	Histogram processing	Sec 3.3
7-9	To learn image enhancement by filtering in the spatial domain	Spatial filtering	Sec. 3.4-3.7
10-11	Review of Fourier domain techniques	Fourier Transforms, DFT, Convolution	4.1-4.6

12-13	Filtering in the Fourier domain	Image smoothing and sharpening using Frequency domain filters	4.7-4.10
14-16	Image Restoration and Reconstruction	Noise Models, Inverse filtering	5.1-5.7
17-19	Image Compression	Basic Compression Methods (DCT)	8.1-8.2
20-23	Morphological Image Processing	Erosion, dilation, Opening closing, Hit-or-miss transformation, some basic morphological algorithms	9.1-9.4, 9.5.1-9.5.7
24-28	Image Segmentation	Point, line and edge detection, thresholding	10.1-10.3
29-32	Representation and description	Boundary following, chain codes, signatures, boundary descriptors, regional descriptors, principal components analysis (PCA)	11.1.1-11.1.2, 11.1.5, 11.2, 11.3.3,11.3.4, 11.4
33–36	Introduction to Medical Imaging and Advances in Medical Image Processing	Image Registration	Class Notes
37 – 42	Object Recognition	Patterns and pattern classes, decision-theoretic methods	12.1-12.2

Evaluation Scheme:

Evaluation Component	Duration	Weightage	Date & Time	Nature of Component
Test I	60 Minutes	30%	13/09 & 2:30-3:30 PM	Open Book
Test II	60 Minutes	30%	21/10 & 2:30-3:30 PM	Closed Book
Comprehensive Examination	3 Hours	40%	13/12 AN	Closed Book

Chamber Consultation Hour: To be announced in the class.

Notices: Notices concerning the course will be put up on the CMS website.

Make-up Policy: Make-up for the tests will be granted only on genuine grounds of sickness **(to be supported by medical certificate and not prescription**) or urgency for going out of town.

Instructor-in-Charge

EEE F435 / ECE F435

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
HYDERABAD CAMPUS
SECOND SEMESTER 2015 - 2016
COURSE HANDOUT (PART II)

Date: 12 / 01 / 2016

In addition to Part I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No : **CS F342**
Course Title : **Computer Architecture**
Instructor-in-charge : **Chetan Kumar V**
Email : chetan@hyderabad.bits-pilani.ac.in

1. Scope and Objective:
This course aims at introducing the concept of computer architecture. It involves design aspects, and deals with the current trends in computing architecture. System resources such as memory technology and I/O subsystems needed to achieve proportional increase in performance will also be discussed.

2. Text Book:
(T1) Patterson, D.A. & J.L. Hennessy, Computer Organization and Design, Elsevier, 4th ed., 2009

3. Reference Books:
(R1) Patterson, D.A. & J.L. Hennessy Computer Architecture: A Quantitative Approach, 5th Edition, 2012
(R2)William Stallings, *Computer Organisation & Architecture,* Pearson, 8th ed., 2010.
(R3) Hamacher et. al, *Computer Organisation*, McGraw Hill, 5th ed., 2002.
(R4) Samir Palnitkar, *Verilog HDL: A Guide to Digital Design and Synthesis*, Pearson Education, Asia, 2003.

4. Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Reference to T1
1	Introduction	Introduction to the course	**1.1-1.3**
2-3	CPU Performance and its factors, Power limit and evolution of CPU	Current Trends in technology, power, Performance, Amdahl's law	**1.4-1.6**
4-9	MIPS Architecture & Instruction Set	Classification of ISA, MIPS Instructions and encoding	**2.1-2.10, 2.16**
10-11	Data path Design	MIPS Processor data path Implementation	**4.1-4.4**
12	Control Hardware	MIPS Processor control path Implementation	**Appendix-D and Class Notes**
13-15	Pipelining Overview, Pipelined Datapath and Control	Pipelining concepts, introduction to Data and Control Hazards, Pipeline Implementation	**4.5-4.6**
16-18	Computer Arithmetic	Implementation of Basic	**3.1-3.4**

		arithmetic operations	
19-20	Floating Point Arithmetic	Implementation of Floating-point arithmetic operations	**3.5-3.7**
21-24	Data Hazards, Control hazards, Branch Prediction	Forwarding, stall condition implementation	**4.7-4.9**
25-26	Memory Organisation Introduction	Organization of memory	**5.1 and Class Notes**
27-29	Basics of cache, Measuring and improving performance of Cache	Basics of cache, Direct mapped, Fully associative, cache performance	**5.2-5.3**
30-31	Virtual Memory	Virtual Memory, Page table, TLB	**5.4**
32-33	Storage and IO Organization	Buses and other connection between processor, memory and I/O devices	**6.1-6.5**
34-35	Interfacing of IO devices	Interfacing of IO devices	**6.6**
36-37	Advanced Topics: Advanced Instruction Level Parallelism	Overview, ILP based processor designs	**4.10, Class Notes**
38-39	Modern Processors: Special Purpose, Multicore	Multicore processor challenges	**7.1-7.6, Class Notes**

5. Evaluation Scheme:

Component	Duration	Maximum Marks	Date & Time	Remarks
Test 1	60 Min	39 (13%)	29/2, 1.00 - 2.00 PM	CB
Test 2	60 Min	39 (13%)	9/4, 1.00 - 2.00 PM	CB
Weekly Lab Experiments + Reports	NA	30 (10%)	Weekly	OB
Lab Examination	120 Min	27 (9%)	Will be announced later	OB
Assignments	NA	30 (10%)	Throughout	OB
Surprise Quizzes	Announced later	30(10%)	Throughout	CB/OB
Comprehensive Examination	3 Hrs	105 (35%)	12/05 FN	CB

6. Chamber Consultation Hours: Tuesday, Wednesday, Thursday from 3:30PM–4:30 PM

8. Notices: Notices regarding the course will be put up on CMS.

9. **Makeup Policy:** No makeup exam allowed without prior permission.

Instructor - in - charge
CS F342

BITS-Pilani, Hyderabad Campus

Second Semester 2016-2017

Course Handout (Part - II)

Date: 19/12/2017

In addition to Part I (General Handout for all courses appended to the Timetable) this portion gives further specific details regarding the course.

Course Number : **EEE ECE F343**
Course Title : **Communication Networks**
Instructor-in-charge : **Subhendu Kumar Sahoo**

1. Course Description:

The course initially deals with big picture of networks with discussion on evolution of network concepts in telegraph, telephone, and computer networks. Then the layered approach of information transmission is discussed in brief. Then some important layers are discussed in detail. These concepts are used to understand the next generation networks.

2. Scope and Objective:

A communication network is one of the fastest growing areas today. The course introduces the concepts and mechanisms underlying the modern telecommunication systems and networks. The course is designed in such a way that the course is accessible to students with minmum technical background in this area. The OSI model is used as a framework to introduce different protocols and standards. Then each layer is covered in detail. Finally some advanced concepts related to all layers are discussed. The course will prepare the student in the areas of telecommunication switching systems, computer networks, and internetworking.

3. Text Books:

Behrouz A. Forouzan; Data communications and networking;TMH; 5th Edition; 2013

4. Reference Book:

R1: Behrouz A. Forouzan; Data communications and networking;TMH; 4th Edition; 2006

R2. A. Leon-Garcia and I. Widjaja: Communication Networks; TMH, 2000.

R3. W. Stallings: Data and Computer Communication; Prentice-Hall, 1997.

R4. Computer Networks: A. S. Tannenbum, D. Wetherall, Prentice Hall, Pearson 5th Ed

5. Course Plan / Schedule:

Lect. No.	Topic	Learning objective	Ref. to Text Book
1.	Introduction	What is Communication Network? Over view of Communication Network, Data representation, Direction of data flow in Communication Network	1.1, 1.4, 1.5
2.	Networks	Network criteria, Physical structures, Physical topology, Categories of networks, The Internet	1.2,1.3
3.	Protocols and standards	Protocol in terms of CN, Need of a standard, Type of standard & steps to create a standard.	1.4
4.	Network models	Layering tasks, The OSI model, Detail discussion of Physical layer.	2 & R1: 2.1,2.2,2.3
5	Network models	Functions of Data link layer and Network layer.	2 & R1: 2.3
6	Network models	Functions of Transport, Session and Presentation layer	2 & R1 2.3

Lect. No.	Topic	Learning objective	Ref. to Text Book
7	Network models	Function of application layer, TCP/IP protocol suit	2 & R1:2.3
RAss.	Signal forms, Digital Signals and transmission impariments Performance parameters and Data rate limit of channel	Data and signal, Analog and digital signal, How the digital signal transimission is effected by various impariments. The limiting factors of a channel data rate.	3.1, 3.2, 3.3, 3.4, 3.5, 3.6
8	Analog Transmission	Modulation of digital data for transmitting in analog channel.	5.1
9	Telephone network for data transmission	Dial-up modems, Digital subscriber line (DSL)	R1: 9.2, 9.3
10	Cable network for data transmission	Technology for data transmission through cable TV network,	14.2
11	Multiplexing	Need of multiplexing, Classification, FDM, WDM, Synchronous TDM Statistical TDM, Spread spectrum, Transmission media	6.1, 6.2
RAss.	Transmission media	Guided and unguided media	7
12	Switching	Circuit switch, Packet switch, Structure of switch,	8.1, 8.2, 8.3, 8.4 & R2- 4.4
13	DLL	Introduction, Link Layer addressing	9.1, 9.2
14	Error detection	Types of error, Block coding	10.1, 10.2
15	Error correction	Cyclic codes, Checksum,	10.3, 10 .4
16	Error correction	Forward error correction	10.5
17	Data link control	Framing, Flow Control and Error Control, DLL Protocols	11.1,11.2
18	Data link control	HDLC, Point to point protocol	11.3, 11.4
19	Multiple access techniques	Random access, Controlled access	12.1,12.2
20	Multiple access techniques	Channelization	12.3
21	Wired LAN	Project 802, Standard Ethernet	13.1, 13.2
22	Wired LAN	Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet	13.3, 13.4, 13.5
23	Other wired networks	SONET	14.3
24	Other wired networks	ATM	14.4
25	Wireless LAN	IEEE 802.11(Wire less Ethernet)	15.1
26	Wireless LAN	Blue tooth (Complex technology For Small wireless LAN)	15.2
RAss.	Other wireless network	Wimax, Celular telephony, Satellite Network	16
27	Backbone Networks and Virtual LANs	Repeaters, Bridges, Routers, Gateway Use of these devices in Backbone Networks and Virtual LANs	17
28	Introduction to Network Layer	Network layer services, Packet switching, NL Performance	18.1, 18.2, 18.3
29	Network Layer	IPv4 addresses, Forwarding of IP packets	18.4, 18.5
30	Network Layer Protocols	Internet protocol, ICMPv4, Mobile IP	19.1, 19.2. 19.3
31	Unicast routing	Least cost routing, Routing algorithms	20.1, 20.2
32	Unicast routing	Unicast routing protocols	20.3
33	Multicast routing	Multicasting basics	21.1, 21.2
34	Next generation IP	IPv6 addressing and protocol	22.1, 22.2
35	Next generation IP	The ICMPv6 protocol, Transition from IPv4 to IPv6	22.3, 22.4
36	Introduction to Transport Layer	TLP, UDP, TCP	23, 24.1, 24.2, 24.3
37	Application Layer	Introduction, Client server programing	25
38	Application Layer	Standard client server protocols, Networkmanagement	26, 27
39	Topics related to all layers	Quality of service, Cryptography and Network Security	30, 31

5. Evaluation Scheme:

Component	Duration	Weightage	Date and Time	Remarks
Test-I	1 hr	20%		Closed Book
Test-II	1 hr	20%		Closed Book
Quiz		15%	Regular	
Lab and Assignment		5%	Will beannounced in class	Open book
Comprehensive	3 hrs	40%		Closed Book (20%) Open Book (20%)
Total		100%		

6. Chamber Consultation Hour: To be announced in Class

7. Make-up Policy: Make-up will be given on extremely genuine grounds only. Prior application should be made for seeking the make-up examination.

8. Notices: Notices, if any, concerning the course will be put up on CMS only.

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
Hyderabad Campus

INSTRUCTION DIVISION
SECOND SEMESTER 2016-2017
Course Handout Part II

Date: 13-1-2017

In addition to Part-I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No. : EEE F344
Course Title : Information Theory and Coding
Instructor-in-charge : P.K.Thiruvikraman

1. Course description: 3 0 3

Random variables and random processes; Information sources and source coding theorem, Kraft inequality, Shannon-Fano codes, Huffman codes, Arithmetic Codes, Lempel-Ziv-Welch algorithm, universal source codes; channel capacity: channel capacity; noisy channel coding theorem for discrete memoryless channels; error control coding: linear block codes and their properties, low density-parity-check codes, BCH codes, Reed-Solomon codes, cryptography: basic concepts on cryptography and cryptoanalysis, security issues; private-key encryption algorithms- stream ciphers, block ciphers, introduction to number theory - modular arithmetic, public-key encryption algorithms- Diffie-Hellman public-key distribution scheme, RSA public-key cryptosystem; Message authentication, digital signatures.

2. Scope & Objective:

1. To apply the concepts of random processes and probability theory to communication subsystems
2. To implement security measures in communication systems using cryptographic principles

3. Text Books

1. Information Theory, Coding and Cryptography, 2nd Ed., Dr. Ranjan Bose, Tata McGrawHill, 2008

4. Reference Books

1. Elements of information theory, Thomas M.Cover and Joy A.Thomas, Wiley-India
2. Foundations of Coding, Jiri Adamek, John Wiley, 1991
3. The Mathematics of Coding Theory, Paul Garrett, Pearson Education, 2005
4. Information Theory, Inference and Learning Algorithms, David Mackay, Cambridge University Press, 2003
5. Coding Theory – A First course, Ling and Xing, Cambridge University press, 2004

5. Course Plan

Lect. No.	Topics to be covered	Learning Objectives	Ref. to Text Book (Sec nos)
1-2	Introduction to Information Theory	Measure of Information	1.1 to 1.2
3-4	Average Mutual Information and Entropy	Concept of Binary Symmetric channel, conditional\l entropy	1.3

5-6	Source coding theorem	Fundamentals of source coding	1.5
7-8	Huffman Coding, Shannon-Fano-Elias Coding		1.6,1.7
9-10	Arithmetic Coding,The Lempel-Ziv algorithm, run length encoding		1.8-1.10
11-13	Introduction to Image Compression	To understand JPEG compression format and lossy compression	1.14 to 1.17
14-15	Wavelets and wavelet transform	Using the wavelet transform for compression	Class notes
16-19	Channel Capacity and Models	To understand Channel capacity & noisy coding theorem	2.1 to 2.9
20-21	Block codes for error correction	Introduction to error correcting codes	3.1 to 3.2
22-23	Matrix description of linear block codes	Parity check matrix, decoding of a linear code	3.3 to 3.6
24-25	Syndrome decoding		3.7 to 3.9
26-27	Hamming codes		3.10 to 3.16
28-29	Cyclic codes	Division algorithm for cyclic codes	4.1 to 4.3
30-33	Matrix description of cyclic codes		4.4 to 4.12
34-37	BCH codes	Generator polynomials, Minimal polynomials	5.1 to 5.10
38-40	Cryptography	Overview of encryption techniques, symmetric key cryptography,	8.1 to 8.4
41-42	Asymmetric key cryptography	The RSA algorithm	8.8 to 8.9

6. **Evaluation Scheme**

Component	Duration	Weightage	Marks	Date & Time	Venue	Remarks
Test I	60 mts.	20%	45		TBA	Closed Book
Test II	60 mts.	20%	45		TBA	Open Book
Assignment		10%	60			Open Book
Surprise Tests*	10 min	10%	30			Open book
Compre	3 hrs	40%	120			Closed Book

* There will be a total of 4 surprise tests and the best 2 performances will be considered.

7. **Chamber Consultation Hour**: Will be announced in the class.

8. **Notices**: Notices concerning this course will be displayed on the EEE department notice board and on CMS.

Instructor-in-Charge
ECE F344

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
HYDERABAD CAMPUS

SECOND SEMESTER 2019-2020

Course Handout (Part-II)

Date: 06.01.20

In addition to general handout for all courses appended to the time table, this portion gives further specific details regarding the course.

Course No. : EEE F111
Course Title : ELECTRICAL SCIENCES
Instructor-in-charge : R. N. Ponnalagu
Instructors: Lectures: R. N. Ponnalagu, Mithun Mondal
Instructors: Tutorials: R. N. Ponnalagu, Mithun Mondal, Sayan Kanungo, S. T. P. Srinivas

1. **Course Description:**

   Course covers basic passive and active circuit elements; network theorems and analysis; introduction to single and three phase systems; magnetic circuits; transformers; electrical machines; semi-conductor diodes and applications; transistors and applications; Digital electronics and commonly used measuring instruments.

2. **Scope and objective of the Course**:

   A basic understanding of the working of electrical and electronic circuits and instruments is essential for all engineers and scientists. This course is designed to give the students of all branches a preliminary exposure to this field. The need for basic understanding in this field will come for non-electrical or electronic students at a later stage in their career growth. For EEE, ECE and E&I students this course acts as a good starting point for their CDCs.
   To obtain basic knowledge on:
   a. Electrical and Magnetic circuits.
   b. Electrical machines.
   c. Semiconductor Diodes and BJTs ; Digital Electronics.

3. **Text Book**: Leonard S. Bobrow: Fundamentals of Electrical Engineering, Oxford University Press, Second Edition, 2005.

4. **Reference Book**:
   Hughes: Electrical and Electronic Technology, Pearson Education, Ninth Edition, 2008.

5. **Course Plan**:

Lect. No.	Learning Objectives	Topics to be covered	Chapter in the Text Book
1	Introduction	Introduction	
2	To study basic circuit elements and the laws;	Voltage and current sources, Independent and Dependent sources resistors and ohm's law, KCL, KVL; Current divider, Voltage divider rule, Instantaneous power	1.1 to 1.5
3-4	To study circuit analysis techniques and theorems.	Nodal and Mesh Analysis	2.1, 2.3
5-6	To study circuit analysis	Thevenin's and Norton's Theorems; Maximum	2.4, 2.5

Lect. No.	Learning Objectives	Topics to be covered	Chapter in the Text Book
	techniques and theorems.	Power Transfer Theorem,	
7-8	To study circuit analysis techniques and theorems.	Linearity and Superposition application in circuit analysis, Source transformation	2.6
9	Inductors and Capacitors	Inductors and capacitors and their integral relationships;	3.1 to 3.2
11-13	To study response of circuits having energy storing elements	First order circuits and natural response; First order circuits and complete response Second Order Circuits	3.3 to 3.6
14-18	Alternating current circuits	A.C. Voltage & Current, Complex numbers, Frequency and time domain analysis	4.1-4.3
19-21	Alternating current circuits	Power and Powerfactor, Poly-Phase circuits	4.4 to 4.7
22-23	Magnetic Circuits	Fundamentals of Electromagnetics, Magnetic fields and their effects, Magnetic Circuits and Materials	14.1-14.2
24-25	Transformers	Introduction , Ideal transformer; Equivalent circuit; Non-ideal transformer;	14.3 -14.5
26-27	Electrical Machines	Motors and generators	15.4
28-31	Principles and Applications of Semiconductor Diodes, Diode Circuits	Semiconductors, doping, Diodes, Zener diodes, effects of capacitance, Half-wave and full wave rectifiers	6.1-6.7
32-35	Bipolar Junction Transistors	*pnp* and *npn* transistors, Characteristics and Applications of BJTs, Application to digital logic circuits	7.1-7.4
36-38	Field Effect Transistors	JFET, MOSFET	8.1-8.2
39-40	Digital Systems	Binary numbers, Binary Arithmetic, Digital logic circuits, Boolean Algebra	11.1-11.6, 12.1
41-43	Circuit Simulation using LTspice		

6. Evaluation Scheme:

Component	Duration	Weightage		Date & Time	Nature of Component
		%	Marks		
Midsem Test	1.5 hour	30	90	4/3 11.00 -12.30 PM	CB
Quizzes surprise/announced	-	30	90	------	CB
Comprehensive Examination	3Hours	20	60	06/05 FN	CB
		20	60		OB
		100	**300**		

7.

Make-up policy: Make-up will be given only under **exceptional circumstances** and with **prior permission**. No makeup will be given for a Quiz evaluation component.

8. Chamber consultation hour: To be announced in the class

9. Notices: Notices concerning the course will be displayed in the CMS.

10.Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Dr. R. N. Ponnalagu

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
HYDERABAD CAMPUS
FIRST SEMESTER 2019-2020
Course Handout

01.08.2019

In addition to general handout for all courses appended to the time table, this portion gives further specific details regarding the course.

Course No.	**: EEE F211, ECE F211, INSTR F211**
Course Title	**: ELECTRICAL MACHINES**
Instructor-in-charge	**: Dr. Alivelu M Parimi**
Team of instructors	
Lecture	**: Dr. Alivelu M Parimi, Dr. Mithun Mondal**
Tutorial	**: Dr. Alivelu M Parimi, Dr. Mithun Mondal**
Practical	**:Dr. Alivelu Manga Parimi, Dr. Mithun Mondal, Dr. Radhika Sudha, Dr. Syed Ershad Ahmed**

1. **Scope and objective of the Course:** To obtain an insight on the principles and performance of the Electrical Machines. To obtain a thorough knowledge on the performance and control of transformers, induction machines, dc machines, synchronous machines during normal and extreme working conditions.
   Transformer: Constructional features, Equivalent circuit and phasor diagram , Regulation and efficiency, Parallel operation , Three phase transformer connections, Testing - open circuit, short circuit and Sumpner's test , Phase conversion – Scott Connection, Autotransformer.
   DC Machines: Construction, principle of operation, armature windings, armature voltage and torque equations, classification and applications. DC generators- armature reaction and performance characteristics; DC motors - torque/speed characteristics, speed control and braking, Testing and efficiency.
   Induction machines: Constructional features and classification, Rotating magnetic field, Equivalent circuit model. Steady state characteristics. Testing, starting and speed control. Wound rotor induction motors, Single phase induction motors - classification and equivalent circuit.
   Synchronous machines: Constructional features and classification , Synchronous generators and motors, Armature Reaction, Equivalent circuit and phasor diagram, Power and torque characteristics, Parallel operation. Synchronous impedance and its determination, Starting and speed control of synchronous motors.

2. **Text Book :**
   1. Nagrath I J and D P Kothari - Electric Machines – Tata McGraw Hill, 4th edition, 2010.
   2. Electrical Machines Laboratory Manual.

3. **Reference Books :**
   1. Edward Hughes, Electrical and Electronics Technology, Pearson, 5th edition 2012
   2. Stephen J. Chapman, Electric Machinery Fundamentals, McGraw Hill , 4th Edition , 2005
   3. P.C. Sen, Principles of Electric Machines and Power Electronics, John Wiley & Sons , 2nd Edition 1996
   4. M.G. Say – Performance and Design of AC machines –Pitman

4. **Course Plan :**

Lec. No.	Learning Objectives	Topic to be covered	Chapter in the Text Book

1-2	Overview of the course and Study of magnetic circuits,	Magnetic Circuits Review	2.1 to 2.2 , 5.1 of T1 7.1 to 7.8 of R1 1.1 to 1.3 of R3
3-6	To learn working of DC Machines	DC Machines principle of operation, Construction and classification, Armature winding, Armature reaction	7.1 to 7.11 of T1 41.1 to 41.6 of R1 4.2 to 4.3 of R3
7	To review principle of operation of DC motor and its characteristics	Shunt, series & compound motors	7.12 to 7.15 of T1 42.1 to 42.6 of R1 4.4 of R3
8-9	Starting , Braking and Speed Control of DC motors	Shunt motor starter step calculation, Speed control, Plugging, Dynamic & Regenerative braking	7.16 to 7.18 of T1 42.7 of R1 9.4 of R2 4.4 of R3
10-11	Performance evaluation of DC machines	Efficiency & Testing of DC machines	7.19, 7.20 of T1
12-15	Transformer operation	Construction, Principle of operation, Equivalent circuit, Phasor diagrams, voltage regulation, efficiency, No-load, full-load and Sumpner's test	3.1 to 3.9, 3.12 of T1 34.1 to 34.19, of R1 2.1 to 2.4 of R3
16	To learn about Auto-transformer	Use & Analysis	3.11 of T1 34.21 of R1 2.5 of R3
17-18	To learn three phase transformer operation	Connections, Phasor groups ,Applications and per unit system	3.13 of T1 2.10 of R2 2.6 to 2.8 of R3
19	To learn parallel operation of transformers	Parallel operation and Load sharing	3.14 of T1
20	To learn about phase conversions and tap changing in transformers	Three phase to two phase conversions (Scott connection) and Tap changing in transformers	3.16 to 3.17 of T1 2.11 of R2
21-24	To learn about principle of operation of three phase induction machine	Construction, Classification, Rotating Magnetic Field , Slip and frequency of rotor currents ,Equivalent Circuit Model , Power Flow and Torque slip characteristics.	9.1 to 9.3 of T1 36.5 to 36.6 and 38.1 to 38.5 of R1 5.1 to 5.7 and

			5.9 to 5.10 of R3
25-29	To learn about testing starting , speed control and braking of three phase induction motor	No-Load and short circuit tests, Starting, Speed control, plugging and regeneration	9.6 to 9.10 of T1 38.6 to 38.10 of R1 5.8 , 5.13 to 5.14 of R3
30-31	Single phase induction motor	Operation & characteristics of single phase induction motor	10.1 to 10.2 of T1 38.11 to 38.14 of R1 7.1 and 7.3 of R3
32-35	To learn about synchronous machines	Operation, circuit model, armature reaction, synchronous impedance and its determination	8.1 to 8.6 of T1 36.1 to 36.4 and 37.1 to 37.3 of R1 6.1- 6.2 and 6.4 of R3
36-40	To learn about synchronizing , operating characteristics of and Power transfer in a synchronous generator	Synchronizing to infinite bus bar, Operating characteristics, Power angle characteristics, Operation at constant load with variable excitation, Power flow equation, power angle characteristics and Parallel operation	8.7 to 8.9 of T1 37.4 of R1 6.5 of R3
41-42	To learn about starting and speed control of synchronous motor.	Starting and speed control techniques of synchronous motor , Application of Synchronous condenser	8.10 to 8.12 of T1 37.6 of R1 6.3,6.7 and 6.10.1 of R3

5. **Evaluation Scheme:**

Component	Duration	Weightage	Date & Time	Nature of Component
Midterm	90 mins	75 Marks (25%)	5/10, 9.00 -- 10.30 AM	CB
LAB Component	Day to Day Evaluation	30 Marks (10%)	Timetable	OB
	Lab Exam	30 Marks (10%)	Will be announced	CB
Quizzes (3)	Will be announced	45 Marks (15%)	Will be announced	CB
Comprehensive Examination	3 Hrs	120 Marks (20%+20%)	13/12 FN	CB+OB

6. **Make-up Policy:** Only those who apply (with genuine reason) **before the start of test** (prior to 24 hours) will be granted permission for make-up.

7. **Notices:** Notices concerning this course will be displayed on CMS.

8. **Academic Honesty and Integrity Policy**:
Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-in-charge
EEE F211/ECE F211/INSTR F211

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE – PILANI, HYDERABAD CAMPUS
FIRST SEMESTER 2022 - 2023
COURSE HANDOUT

Date:29-08-2022

In addition to part I (General handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course Number	:	PHY F212, ECE F212, EEE F212, INSTR F212
Course Title	:	Electromagnetic Theory I
Instructor-in-Charge	:	Subhash Karbelkar
Instructors	:	Sarmistha Banik , Sankar Davuluri , Aranya Bhuti Bhattacherjee, Prasant Samantray

Scope & Objective of the course:

Electromagnetic theory forms an important ingredient, along with the quantum theory, of the physics behind the technology we use and design today. Building on the electromagnetic theory, studied in the XII standard, this course augments students' understanding of electromagnetic fields to a level from where they can take up advanced learning in this field. Students are strongly advised to revise what they have learnt in XII using the textbook as it may lead to deeper/newer insights.

Text Book: *Introduction to Electrodynamics,* David J. Griffiths, Third Edition, Pearson Education Inc., 1999.

Reference Books:

1. *The Feynman Lectures on Physics: Volume II*, Richard P. Feynman, Robert B. Leighton, Matthew Sands, The New Millennium Edition, Pearson Education Inc. 2013.

Learning Outcomes:

1. Ability to evaluate the Gradient, Curl and Divergence of Scalar and Vector Fields in Cartesian Coordinates, Cylindrical Polar Coordinates and Spherical Polar Coordinates.
2. Ability to deal with the Electric and Magnetic fields in space as well as in matter in static as well as time variable situations.
3. Ability to apply Maxwell's equations to a given problem.

COURSE HANDOUT

Lecture Number	Learning Objectives	Topics to be covered	Chapter in the Text Book
1	Relation of Electromagnetism to other areas of Physics	Introduction: The scope of EMT 1	CLASS LECTURE
2-11	Vector Analysis	Vector differential and integral calculus; Gradient, Curvilinear co-	1.2-1.6

		ordinates (cylindrical, spherical and cartesian), Theorem of curl, divergence and gradient, Dirac Delta Function, Helmholtz theorem and potentials	
12-16	Electrostatics	Divergence and curl of electrostatic fields; electric potential, work and energy in electrostatics	2.2-2.5
17-20	Some special mathematical techniques	Method of images, Multipole expansion	3.2 and 3.4 (Exclude 3.3)
21-24	Electric Fields in Matter	Polarization, bound charges, electric displacement, Linear dielectrics.	4.1 - 4.4
25-29	Magneto statics	Divergence and curl of B Magnetic vector potential.	5.1 - 5.4
30-36	Electrodynamics	Maxwell's equations	7.3.1 to 7.3.5 exclude 7.3.4
37-40	Electromagnetic Waves	EM waves in vacuum	9.2

Evaluation Scheme:

EC No.	Evaluation Component	Duration	Weightage (%)	Date, Time	Nature of Component
1	Mid Sem Test	90 Min.	35	02/11 11.00 - 12.30PM	Closed Book
2	Quiz-1	50 Min.	12.5	TBA	Open Book
3	Quiz-2	50 min	12.5	TBA	Open Book
3	Comprehensive Exam	180 Min.	40	22/12 AN	Closed Book

Chamber Consultation Hour: To be announced later

Notices: Notices and solutions of Quizzes, Mid-Semester & Final Comprehensive Examination will be displayed on CMS.

Make-up Policy: In case of all pre-compre evaluation components, make up will be granted only on production of evidential documents with prior permission from the IC.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-in-Charge

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
HYDERABAD CAMPUS
FIRST SEMESTER 2019-2020
Course Handout Part II

01/08/2019

In addition to part -I (General Handout for all courses appended to the Time Table), this portion gives further specific details regarding the course.

Course No.	:	EEE F214 / ECE F214/ INSTR F214
Course Title	:	Electronic Devices
Instructor-in-Charge	:	Souvik Kundu
Lecture Instructors	:	Souvik Kundu & Sayan Kanungo
Tutorial Instructors	:	Souvik Kundu, Ramakant Jadav, Michael Preetam Raj and Pavan Kumar Reddy

1. Scope and Learning Outcome:

i. Understanding the relationship between atomic structure and physical properties of semiconductors.
ii. Interpreting electronic band structure using quantum mechanics.
iii. Identifying the semiconductor properties that determine the performance of electronic devices.
iv. Calculating the carrier concentrations and conductivity of a semiconductor using given doping concentrations.
v. Understanding the basic physics of charge carriers in solids and carrier transport in semiconductors.
vi. Deriving equations of charge transport in semiconductors under normal operating conditions.
vii. Applying the charge diffusion equation to electronic devices and deriving their I-V characteristics.
viii. Utilizing defect densities and carrier recombination processes to calculate generation and recombination rates in semiconductor devices.
ix. Understanding the basics of optoelectronic devices.

2. Text Book:

B. G. Streetman, and Sanjay Banerjee, “Solid State Electronic Devices”, 6th Ed., PHI, 2006

3. Reference Book:

D A. Neaman, “Semiconductor Physics and Devices”, 4e, Tata Mc Graw Hill.

4. Course Plan:

Lecture No.	Topics to be covered	Learning Outcomes	Chapter in the Text Book
1	Introduction to the subject and course details		
2-5	Review of semiconductor fundamentals.	Fundamentals of quantum physics, Schrödinger wave equation, tunneling, uncertainty principle, KP model.	3.1.3, 3.1.4, 3.2
6-8	Crystal Structure	Cubic Lattices, Planes & Directions	1.2.1 – 1.2.3

9-11	Charge carriers in semiconductors,	Fermi level, Density of states, equilibrium carrier concentrations, temperature dependence, space charge neutrality	3.3
12-14	Effect of electric and magnetic fields on drift of carriers	Conductivity and mobility, Hall effect	3.4-3.5
15-19	Excess carriers in semiconductors	Interaction of photons with semiconductors, generation and recombination mechanisms of excess carriers, quasi-fermi levels in non-equilibrium	4.1 – 4.4
20-27	Junctions	PN junctions, I-V characteristics, biasing, breakdown diodes, Metal semiconductor junctions, Tunnel Diode, Varactor diode	5.2 – 5.7, 10.1
28-32	Field Effect Transistors	To understand the structure and working of JFET, MOSFET, I-V characteristics and secondary effects	6.2,6.3.1,6.3.3, 6.4.1-6.4.5, 6.5.1-6.5.4, 6.5.6,6.5.8
33-38	Optoelectronic devices	Photoelectric effect, Solar cells, Photodiodes, Light Emitting Diodes(LED), Lasers and Semiconductor Lasers	2.2.1, 8.1–8.4
39-42	Bipolar Junction Transistors	BJT operations, amplifications, carrier distribution, I-V characteristics etc. and secondary effects,	7.1, 7.3 –7.7, 7.9

5. Evaluation Scheme:

Component	Duration	Weightage	Marks (200) (%)	Date & Time	Nature of Component
Mid-Sem	90 min	30%	60	4/10, 11.00 -- 12.30 PM	Closed Book
Open Book Quiz	50 min	25%	50	To be announced in class	Open Book
Comprehensive Exam.	3 hours	45%	90	11/12 AN	Closed Book
Total		100%	200		

6. Chamber Consultation hours: To be announced in the class.

7. Notices: All notices for the course will be announced in the class and displayed only on the CMS.

Make-up Policy: Requests for make-up examination will be entertained ONLY for extremely serious cases where:
i) Written & signed documentary evidence needs to be provided from the Hostel Warden confirming the reason for absence from scheduled examination

(ii) In case of medical emergencies, students must produce a documentary evidence from the surgeon and hostel warden.

Academic Honesty and Integrity Policy:
Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of

academic dishonesty is acceptable.

Instructor-in-Charge
Souvik Kundu

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI- HYDERABAD CAMPUS
INSTRUCTION DIVISION, SECOND SEMESTER 2015-2016
COURSE HANDOUT (PART II)

Date:12/01/2016

In addition to part-I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No. **:ECE F242, EEE F242, INSTR F242**
Course Title **: Control Systems**
Instructor-in-charge **: Madhuri Bayya**
Instructors **: Sunita Singh, Dr.Alivelu Manga Parimi**

1. Scope & Objective of the Course:
Feedback automatic control systems are an essential feature of numerous industrial processes, scientific instruments and even commercial, social and management situations. A thorough understanding of the elementary principles of this all embracing technology is of great relevance for all engineers and scientists. This course tries to bring out the basic principles of Feedback Control Systems.

2. Text Book: Nagrath I. J. and M. Gopal, Control Systems Engineering, New Age International (P) Limited, 5th ed, 2007.

3. Reference Books:
(i) Kuo, B. C., and Golnaraghi, F., Automatic Control Systems,John Wiley & Sons, 8th ed, 2003.
(ii)Dorf, R. C., and Bishop, R. H., Modern Control Systems, Addison Wesley, 7th ed, 1995.

4. Course Plan:

Lect. No.	Learning objectives	Topics to be covered	Text Book
1	Introduction Control system terminology-system, control, feedback, transfer function. Linear Time invariant system	General understanding of the concept of control. Identification of various examples encountered in life from engineering and non-engineering fields as well.	1.1-1.4
2	Introduction to Laplace transform and its application to control systems	Basics of Laplace transform to derive the transfer function of control system, linear approximation technique	Class Notes
3	Mathematical Modelling. Integro-differential equations for electrical, mechanical systems and Transfer functions, , Gear reduction, disturbance input	Understanding examples from various fields and making block diagram model of the same. Working out transfer function by various methods and gears	2.1, 2.2
4	Mathematical modelling of electromechanical system – example of control of armature and field controlled DC motor as a drive	Understanding the electromechanical system with DC motor as an example and developing the block diagram	2.4
5-6	Block diagram development, closed loop transfer function	Developing a block diagram of applications	2.5
7-8	Signal flow graph Mason's gain formula, Various Examples	Developing the signal flow graph of a system	2.6,
9	Open loop and closed loop example. Effect on gain, dynamic response	Learning about more examples of open loop and closed loop control systems and their	3.1

	disturbance input	comparison	
10	Sensitivity to parameter variation. Concept of frequency content in signals, regenerative feedback, further examples	To learn the control of system sensitive to parameter variations	3.2, 3.6, 3.7
11	Examples of servomotor, stepper motor	Linearization concept, block diagram and transfer function of real life examples.	4.1, 4,2, 4.3,4.4
12	Hydraulic control system Pneumatic control components	Block diagram and transfer function development	4.5, 4.6
13-14	Various Test signals in time domain, Response of zeroth and first order systems Second order systems	Transient and natural response analysis of dynamic first order systems to different excitations	5.1, 5.2, 5.3 5.4
15-16	Time response specifications of second order systems, error constants, effect of adding pole(s)/zero(s)	Transient and natural response analysis of dynamic second order systems to different excitations	5.4, 5,5, 5.6
17-18	Compensation Techniques Higher order systems.	To design control system for given time domain specifications.	5.7, 5.8, 5.10
19	Stability; Routh criterion	To apply Routh Test to closed loop system stability study.	6.1, 6.2, 6.3, 6.4, 6.6
20	Root Locus. Introduction, Magnitude and Angle criterion	To draw root locus for various systems and there from infer information on time response and stability	7.1, 7.2
21	Root Locus for second order systems without zero and with zeros	- do -	7.2
22	Other rules of root locus. Higher order examples.	- do -	7.3 7.5
23	Higher order examples (contd.) Root contours	- do -	7.4
24	Frequency Response; Introduction, Polar plot	To plot frequency response of systems and use for analysis by frequency domain approach.	8.1, 8.2, 8.3
25-26	Bode plot	- do -	8.4
27	Identification of Transfer function from Bode plot, Gain margin and phase margin	- do -	8.5 & 8.6,9.4
28	Nyquist criterion; Introduction. Nyquist contour	Investigation of the stability of closed loop system using their open loop transfer function frequency plot.	9.1, 9.2, 9.3
29-30	Nyquist stability criterion. Various Examples	- do -	9.3
31-34	Introduction to Design	To design lag, lead compensators, Tuning of PID controllers	10.1-10.7
35-39	State variable analysis and design	Analysis and design of a system using state variable approach	12.1 to 12..9

5. Evaluation Scheme:

Component	Duration	Weightage	Date & Time	Remarks
Test I	60 min	15%	26/2,4.00 - 5 .00 PM	CB
Test II	60 min	15%	12/4, 4.00 - 5 .00 PM	CB
Assignments	-	20%		OB
Surprise quiz		10%		CB
Comprehensive Exam.	3 hours	40%	06/05 AN	CB

6. **Chamber Consultation Hours:** to be announced in the class.

7. **Notices:** All notices will be displayed only on CMS

Instructor-In-Charge
ECE F242, EEE F242, INSTR F242

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI-Hyderabad Campus
INSTRUCTION DIVISION
SECOND SEMESTER 2015 - 2016
COURSE HANDOUT (PART II)

12-01-2016

In addition to Part I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No	: **EEE / ECE / INSTR F243**
Course Title	: **Signals & Systems**
Instructor-in-charge	: PRABHAKAR RAO
Instructors	: Prabhakara Rao, Venkateswaran Rajagopalan, Shrivishal Tripathi

1. Scope and Objective :

This course is a preparatory course in which the basics of signal processing are covered. It deals with the basic transforms used in signal processing & introduces the analog & digital filters. For practical exposure Matlab based assignments are included. The students are required to review following mathematical topics: Calculus, Vector analysis, Fourier Series, Laplace Transform, Complex variables and Statistics.

2. Text Book :

T1: Lathi B P, Principles of *Signal Processing & Linear Systems* Oxford University Press, 2009.

3. Reference Book :

R1: A V Oppenheim, A S Willsky, Nawab S N, *"Signals & Systems"*, PHI, Second Edition, 2006
R2: Nagrath I J, Sharan S N, Ranjan Rakesh & Kumar S, S*ignals & Systems*, Second Edition TMH, 2001.

4. Course Plan :

Lecture No.	Learning Objectives	Topics to be covered	Reference
1	Handout description and importance of the course	Introduction to course	-------
2 - 4	Understanding different types of continuous time signals and performing different time signal operations	Classification of Signals & Signal operations	T1: 1.1 - 1.3
5 - 7	Signal representation using basis signals	Fourier series	T1: 3.3- 3.5
8 - 10	Synthesize and analysis of various continuous time signals	Fourier Transforms & its properties	T1: 4.1-4.3 (exclude 4.3-6)
11	Defining various systems	Classification of Systems	T1: 1.6 & 1.7
12 - 13	Obtaining of system output for any arbitrary input signal using impulse response	Linear convolution & Linear Convolution using Fourier Transform	T1: 2.4 & 4.3-6
14 - 15	Studying exponentially growing signals and analyzing stable systems	Laplace transform & its properties	T1: 6.1 - 6.2
16	Analyzing stable systems	Solution of LTI continuous time systems using Laplace transforms	T1: 6.3
17 - 20	Study of frequency response of different systems	Introduction to analog filters	T1: 7.1 & 7.4
21 - 22	Understanding different types of discrete time signals and performing different time signal operations	Discrete-time signals & Signal operations	T1: 8.1 - 8.2 & 8.4
23 - 24	Sampling of continuous time signals and their recovery	Sampling & reconstruction	T1: 5.1
25 - 26	Synthesize and analysis of various discrete time signals	Discrete Time Fourier Transform & its properties	T1: 10.2 - 10.4
27	Numerical computation of Fourier transform	DFT & its Properties	T1: 5.2
28 - 30	DFT method using FFT algorithms	Fast Fourier Transform, DIT FFT & DIF FFT algorithms	T1: 5.3
31 - 32	DFT & IDFT using FFT algorithms	DFT using FFT & Inverse DFT	T1 : 10.6 (exclude 10.6-3)
33 - 35	Obtaining output for discrete time systems for any arbitrary discrete input signal	Discrete time systems, Discrete time convolution & Discrete time convolution using FFT	T1 : 9.4-1 & 10.5 & 10.6-3
36	Analyzing discrete time stable systems	Time domain analysis of discrete time systems	T1 : 9.5
37 - 38	Analysis of discrete time systems	Z-transforms & its properties	T1 : 11.1 – 11.2
39	Inverse z-transforms	Inverse Z-transforms, System response using Z-transform	T1 : 11.3

5. Evaluation Scheme

EC No.	Evaluation Component	Duration (min)	Weightage (%)	Date & Time	Nature of Component
1	Test I	60	15	27/2,2.30 - 3.30 PM	Closed Book
2	Test II	60	15	11/4, 2.30 - 3.30 PM	Closed Book
3	Assignment	__	20		Open Book
4	Surprise quizzes	__	10		Closed Book
4	Comprehensive	180	40	10/05 AN	Closed Book

6. Chamber Consultation Hours: To be announced in the class.

7. Make-up Policy:

Make Up for any component will be given only in genuine cases. In all cases prior intimation must be given to IC.

Instructor-in–charge

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI, HYDERABAD CAMPUS
INSTRUCTION DIVISION, SECOND SEMESTER 2015-2016
COURSE HANDOUT (PART II)

12-01-2016

In addition to part-I (General Handout for all courses appended to the time-table), this portion gives further specific details regarding the course.

Course No. : **ECE F244 / EEE F244 / INSTR F244**

Course Title : **Microelectronic Circuits**
Instructor-in-charge : **S. R. Zinka**

Team of Instructors
(i) For Lecture : **Surya Shankar Dan and S. R. Zinka**
(ii) For Tutorial : **Surya Shankar Dan and S. R. Zinka**

1. **Scope and Objective of the Course:**

The objective of this course is to develop an ability to analyze and design integrated electronic circuits. The course aims at thorough understanding of electronic circuits & building blocks necessary for effective realizations of integrated circuits. The course also includes the practical component.

2. **Text Book:**

Adel. S. Sedra, Kenneth C Smith, "Microelectronic Circuits", Oxford University Press, Sixth Edition, 2013. [**T1**]

3. **Reference books:**

Richard. C. Jaeger, "Microelectronic Circuit Design", Tata McGraw-Hill Companies Inc., International Edition. [**R1**]

R. Jacob. Baker, Harry. W. Li, David. Boyce, "CMOS circuit Design Layout and simulation." IEEE Press series on Microelectronic Systems, PHI. [**R2**]

5 Course Plan :

S.No.	Topics to be covered	Learning Objective	No. of Lectures	Ref. From the Text Book (Article)
1.	Introduction to amplifiers, review of basic network theory, and feedback	Characteristic of amplifiers and feedback concepts	6	T1: 1.4 -- 1.6 T1: 7.1 – 7.6
2.	Ideal Operational Amplifiers	Design and characterization of ideal OP-AMP circuits	6	T1: 5.1 – 5.10
3	Models and physics of MOSFET	MOS device physics	3	T1: 4.1 – 4.6
4	MOSFET Amplifier and Frequency response	Discrete MOSFET Amplifier design	5	T1: 4.7 – 4.10
5	Models and physics of BJT	BJT device physics	2	T1: 3.1 – 3.6

6	BJT Amplifiers and frequency response	Discrete BJT Amplifier design	4	T1: 3.7 – 3.10
7	Feedback in BJT and MOSFET circuits	Study of feedback	3	T1: 7.1 – 7.11
8	Differential amplifiers	Design of differential amplifiers	5	T1: 8.1 – 8.7
9	Passive and active current mirrors	Design of IC bias circuits	4	T1: 6.3, 6.4, 6.14
10	Review & Overview of state of the art IC manufacturing	Building of electronic systems	1	Lecture Notes
			39	

6. **Evaluation Scheme:**

EC No.	Components	Duration	Weightage (%)	Date & Time	Remarks
1	Test-1	60 mts.	15	1/3, 4.00 - 5 .00 PM	CB
2	Test-2	60 mts.	15	7/4, 4.00 - 5 .00 PM	CB
3	Surprise Quizzes	-	10	-	CB
4	Assignments (Take Home)	-	20	Continuous	OB
5	Comprehensive Exam	3 hrs.	40	14/05 AN	CB

7. **Chamber Consultation Hour:** To be announced in the class

8. **Make-up Policy:**

- Make-up for any component will be given only in genuine cases.
- In all cases prior intimation must be given to IC

9. **Notices:** All notices related to the course will be put on **CMS** only.

Instructor-in-charge
ECEF244 / EEE F244/ INSTR F244

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI- HYDERABAD CAMPUS
INSTRUCTION DIVISION, FIRST SEMESTER 2015-2016
COURSE HANDOUT PART II

Date: 01 –08 - 2015

In addition to Part-I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No. : ECE F311 / EEE F311
Course Title : Communication Systems
Instructor-in-charge : S. R. Zinka
Instructors : Prof. Y. Yoganandam, Prof. Runa Kumari

1. Course description:

Analysis and design of communication systems; analog and digital modulation and demodulation, frequency conversion, multiplexing, noise and distortion; spectral and signal-to-noise ratio analysis, probability of error in digital systems, spread spectrum. Introduction to the basic principles of the design and analysis of modern digital communication systems. Topics include source coding, channel coding, baseband and passband modulation techniques, receiver design, and channel equalization.

2. Scope & Objective:

This course intends to cover the basic understanding of functionalities of various block-sets involved in communication system. The topics like Analog to Digital conversion, Pulse coding, Modulation (Analog and Digital, Baseband and Bandpass), source coding, channel coding, Multiple access, Multiplexing techniques, Spread spectrum will be covered with appropriate detail and mathematical description. Important topic like Information theory and its fundamental limits will be emphasized to appreciate the concepts of digital communication. Students will be introduced to the functioning of modern communication systems and how they perform in the presence of noise. Students will be given assignments on communication system modeling using MATLAB. The laboratory component involves system design and simulation exercises using MATLAB and Simulink and experiments based on HW boards. Advance/application areas like wireless, optical, satellite, acoustic communication will be covered towards the end. Students are expected to have sound understanding of Signals and systems, Mathematics, Electromagnetic Field theory.

3. Text Books

T1 B.P. Lathi and Zhi Ding, Modern Digital and Analog Communication Systems, 3rd OR 4th Edition, Oxford University Press, 2010

T2 Simon Haykin & Michael Moher, Communication Systems, 4th OR 5th Edition, John Wiley & Sons, 2010

4. Reference Books

R1. Proakis John, Digital Communications, 4th Edition, TMH

R2. K. Sam Shanmugam, Digital and Analog communication systems, John Wiley & Sons

R3. DIGITAL COMMUNICATIONS Fundamentals and Applications: ERNARD SKLAR and Pabitra Kumar Ray; Pearson Education 2009, 2/e.

4. Course Plan

Sl. No	Topics to be covered	Learning Objectives	Ref. to Book	No. of Lectures
1	Overview of the course, introduction to communication systems.	History of electronic communications, blocks of a typical communication system, Electronic Communication Channels, twisted pair, cable, wave guide, wireless channels, need for modulation, concept of a carrier, analog and digital communication concepts.	T1& T2:Chapter 1	1
2	Deterministic and random signals and their properties	Signals, nature of signals, Review of energy and power signals, correlation functions, power and energy spectral densities, Fourier series and Fourier Transforms, signal distortions. Real world signals, pure, distorted and noise corrupted signal examples, typical BW of various signals.	T1: Chapters 2 & 3 T2:Chapter 2	2
3	Random variables, processes and Noise	Recap of Probability, Random variables & processes, statistical averages, Power spectral density, Gaussian process, Noise, Nature of noise,	T1:Chapter 8,9 T2:Chapter 5	3

		Sources of Noise, white noise, KTB, Noise Figure and Noise temperature, calculations, Signal-to-Noise ratio.	R3:Chapter 5	
4	Transmission and reception of analog Signals: Amplitude modulation (AM)	Different Amplitude Modulation Techniques: DSB-SC, SSB-SC, VSB, AM with carrier: BW requirements of above modulation schemes. Circuits for Generation and demodulation. Noise performance of different AM systems. Frequency Division multiplexing, Super heterodyne Receivers, Practical circuits	T1:Chapter 4 T2:Chapter 3,6 R2:Chapter 7	5
5	Transmission and reception of analog Signals: Angle Modulation Phase & Frequency modulation	Angle modulation, FM transmitter and receivers, interference and bandwidth considerations, comparison of AM and FM, FM generation and demodulation, Noise performance of different Angle Modulation systems.	T1:Chapter 5 T2:Chapter 4,6 R2:Chapter 7	4
6	Digital Representation of Analog Signals and Pulse Modulation	Sampling theorem, aliasing, quantization and encoding, PAM, TDM, PPM, PWM, Quantization, PCM, Delta Modulation	T1:Chapter 6 T2:Chapter 7 R2:Chapter 10	4
7	Baseband Transmission of Digital Signals	Line codes, NRZ etc, Inter Symbol Interference (ISI), eye diagram, Nyquist Criterion for Distortionless transmission, pulse shaping, equalization	T1:Chapter 7 T2:Chapter 8	4
8	Baseband Reception of Digital Signals and Noise performance	Probability of error due to Noise, detection of digital signal in noise, threshold determination, Bit Error Probability concepts, Matched Filter, bit Energy and BER Vs Bit Energy curves	T1:Chapter 10 R3:Chapter 3	4
9	Band-Pass transmission of Digital signals	Band-Pass Transmission Model, Binary PSK ,FSK and QAM, M-Array Data Transmission Systems, Noise performance of PSK & FSK Systems	T2:Chapter 9 T1:Chapter 10 R3:Chapter 4 R2:Chapter 8	5
10	Information & Forward Error Correction	Measure of information, entropy, Source Coding Theorem, discrete memory less channels, Channel capacity & Channel Coding, Error Control Codes, Linear block & convolutional codes	T1:Chapter 13,14 T2:Chapter 10 R3:Chapter 6 R2:Chapter 9	5
11	Digital receiver design & performance analysis.	Goals of Communication system designer, Error probability plane, Nyquist bandwidth, Shannon-Hartley capacity theorem, bandwidth-Efficiency plane, BW efficiency of different modulation schemes, Modulation & coding trade-offs, Designing digital communication systems, Modulation & coding for Bandwidth limited channels	R3:Chapter 9	3
12	Introduction to Spread spectrum systems	Concept of spread spectrum, PN sequences and their use in communication systems,	T1: Chapter 11 R3:Chapter 12	2
13	Emerging Trends in Communication Systems: Optical and Mobile communications.	A brief overview of different communication technologies	Supplementary notes	1
		Total Number of Lectures		43

Laboratory component: Laboratory exercises will involve simulations using MATLAB. Also, experiments will be conducted using HW boards, Signal Sources, Oscilloscopes & spectrum analyzer.

6. **Evaluation Scheme**

Component	Duration	Weightage	Marks	Date & Time	Remarks
Test I	60 mts.	16.66%	50	14/9, 10.00--11 AM	Closed Book
Test II	60 mts.	16.66%	50	7/11, 10.00--11 AM	Closed Book
Final lab Exam		10%	30		Experiment to be performed & viva--voce
Regular Lab Component		13.33%	40		Lab attendance and performing of experiment
Home Assignment		6.67%	20		
Comprehensive	3 Hrs	36.6%	110	05/12 AN	Closed Book
Totals		**100%**	**300**		

7. **Chamber Consultation Hour**: Will be announced in the class.

8. **Notices**: Notices concerning this course will be on CMS.

S. R. Zinka

Instructor-in-Charge

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI, HYDERABAD CAMPUS
INSTRUCTION DIVISION, FIRST SEMESTER 2016-2017
Course Handout (Part-II)

Date: 01/08/2016

Course No. **: ECE F314**

Course Title **: Electromagnetic Fields and Microwave Engineering**

Instructor-in-charge **: Dr. Prasant Kumar Pattnaik**

Course Description:

Electromagnetic waves; Maxwell's equations; Poynting theorem and wave equations; propagation of EM waves; transmission lines; microstrip lines; wave guides; cavities and antennas; microwave generators, microwave amplifiers; measurement at microwave frequencies.

Scope and objective of the course:

Electromagnetics is one of the most fundamental topics in Electrical Engineering. Maxwell's four simple equations form the basis for almost all phenomena in Electrical and Communication Engineering. Thorough understanding of many areas such as VLSI, PCBs operating at GHz clocks, rotating machines, microwaves and antennas depends upon electromagnetics. The emphasis will be placed on both physical concepts and mathematical equations. An effort will be made to show that electromagnetic is not a dull and dry area with lot of mathematics but something beyond it. The objective of this course is to provide the students with the basic understanding of electromagnetic fields and microwaves. The material covered in this course is basic to the training of electrical engineers.

1. **Text Book :**
   John D. Kraus and Daniel A. Fleisch, "Electromagnetics", 5th ed., McGraw-Hill, New York, 1999.

2. **Reference Books :**
   i) RB1: Samuel Y. Liao, "Microwave devices and circuits" 3rd ed.,PHI 2008.
   ii) RB2: Annapurna Das and Sisir Das, "Microwave Engineering", TMH 2009.
   iii) RB3: David Pozar, "Microwave Engineering", 4th edition,John Wiley & Sons, 2012.
   iv) RB4: J.D Krauss et.al., "Antennas and Wave Propagation", 4th edition, TMH 2010.
   v) RB5: Matthew N.O.Sadiku, "Principles of Electromagnetics" 4th ed. Oxford University Press, New Delhi, 2009.
   vi) RB6: David K.Cheng, "Field and Wave Electromagnetics" 2nd ed. Pearson Education, New Delhi, 2009.
   vii) RB7: EDD Notes: "Smith Chart and its Applications", BITS, Pilani, 2009.

3. Course Plan:

Lec. No.	Topic to be covered	Learning Objective	Ref. To Text Book and Reference Book
1-2	Maxwell's equations, Plane wave propagation in conducting and dielectric	Understand the propagation of waves through space and various kinds of media	4.2-4.6 (TB)

	media		
3-4	Energy relations and Poynting Vector& Wave polarisation	How energy is stored and transmitted by EM wave	4.10-4.12 (TB)
5-6	Reflection & refraction of plane waves	Behaviour of plane waves at the interface between two media	4.7-4.9,4.14(TB)
7-8	Transmission lines	Analysis of transmission lines and their circuit behaviour	3.1-3.4 (TB)
9-10	Impedance matching	How to solve transmission line problems using Smith Chart	3.4-3.5 (TB)
11-12	Waveguides	General Wave behaviour along uniform guiding structures, TEM waves, TM waves, TE waves	8.1-8.3 (TB)
13-15	Waveguides	Parallel-plate, Rectangular & Circular waveguides	8.4 (TB) and 4.1-4.2(RB1)
16	Cavity Resonator	Rectangular cavity resonator and quality factor	8.12 (TB) and 4.3 (RB1)
17-18	Microwave Network theory and Passive Devices	Microwave hybrid circuits, Directional couplers, Circulators and Isolators.	Class notes and 4.4-4.6 (RB1)
19-20	Microstrip Lines & MMIC	Study of microstrip lines	11.1 (RB1)
21-22	Microwave Generators	Introduce the microwave generation concepts with Gunn diode and Klystron tubes	7.1-7.3,9.1-9.2,9.4 (RB1) & 9.2, 10.2-10.3 (RB2)
23-25	Microwave amplifiers, Microwave measurements	Types of amplifiers, classes based on operating point, measurements	Class Notes & 13.2-13.17 (RB2)
26-28	Antennas and Antennas Arrays	Antenna parameters, basic antenna elements, Antenna Equivalent circuit, Antenna arrays, Antenna patterns, Tapering etc	5.2-5.3(TB)
29-30	Dipole antennas	Retarded Potential, Hertzian dipole, Half wave dipole,	5.4-5.9 (TB)
31-32	Different types of Antennas	Small loop antenna, Slot antenna, Horn antenna, Helical antenna and Log periodic antenna	5.4-5.9 (TB)
33-35	Radio wave propagation	Radio link and Friis formula, radar equation, etc.	5.10-5.12 (TB)
36-37	Antenna measurements	To measure antenna ranges, gain, directivity and radiation efficiency of an antenna	19.1-19.6 (RB4)
38-40	Special Topics	RF MEMS, Computational Electromagnetics	Class notes

4. Evaluation Scheme:

Component	Duration	Percentage	Marks	Date & Time	Evaluation type
Test-I	60 min	25 %	75	13/09 &10:00 to 11:00 A.M	Open Book
Test-II	60 min	25 %	75	21/10 & 10:00 to 11:00 A.M	Closed Book
Assignments	---	10%	30	Take home	Open Book
Compre. Exam.	3 hours	40 %	120	14/12/2016 AN	Closed Book
Total			**300**		

5. Chamber Consultation Hour: To be announced in the class

email: pkpattnaik@hyderabad.bits-pilani.ac.in

6. **Notices:** EEE Notice Board and CMS.

7. **Make-up Examination:**

Makeup for Tests and Comprehensive Examination will be given only in **extremely genuine cases** for which prior permission of the instructor-in-charge is required.

Instructor-in-charge
ECE F314

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
INSTRUCTION DIVISION
FIRST SEMESTER 2016 - 2017
COURSE HANDOUT (PART II)

Date: 01 / 08 / 2016

In addition to Part I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No : **ECE F434**
Course Title : **Digital Signal Processing**
Instructor-in-charge : S. K. Sahoo
Instructors : Ramakant Yadav, BVVSN Prabhakar Rao, R Venkateswaran, S K Chatterjee, Ganesh Kumar, P Spandana,

1. Course Description:

This course deals with the design of analog filters like Butterworth, Chebyshev, Elliptic., digital filter design for both IIR & FIR filters. Different filter structures for the realization of digital filters will be discussed. Finite word length effects and Multirate DSP will be introduced. DSP Processor architecture and implementation of DSP algorithms will be part of the course, which will be emphasized upon.

2. Scope and Objective:

The course aims at enumerating the theoretical and practical aspects of modern signal processing in a digital environment. It also aims at discussing application areas with particular stress on speech and image data.

3. Text Book:
"Digital Signal Processing", Sanjit K Mitra, TMH, Third Ed., 2006.

4. Reference Books:

1. "Digital Signal Processing : Principles, Algorithms and Application", John G Proakis & D G Manolakis, PHI, 1998.
2. "Digital Signal Processing: A Practical Approach, Second Edition", Emmanuel C. Ifeachor and Barrie W. Jervis, Pearson education.
3. "Digital Signal Processing: Fundamentals and Applications", Li Tan, Elsevier.
4. "Digital Signal Processing", Oppenhiem & Schafer, Pearson Education Asia, 2002.
5. TI DSP Processor User Manuals
6. MATLAB Help
7. IEEE transactions on Computer aided design, circuits and systems, signal processing

5. Course Plan:

Lecture No.	Learning Objectives	Topics to be covered	Reference
1	Overview of the course	Introduction	-------
2	DSP Architectures	General DSP architectural aspects	Class notes

3	DSP Architectures	Numeric representation used in DSP	Class notes
4,5	DSP Architectures	Architectural details of a typical DSP processor	R5
6-9	Z- Transform and its application	Basics of Z- transform and its use for analysis of LTI systems	Chapter 6
10,11	Discrete time Fourier transform	CTFT, DTFT, Phase and group delay	Chapter 3
12	Finite length discrete transform	DFT, FFT	Chapter 5
13-16	Analog filter design	Butterworth,Chebyshev, Elliptic & Bessel Filters	Chapter 4
17	Analog filter design	Design of HP, BP and BS filters	4.5
18	Sampling	Sampling lowpass & bandpass signals	4.2, 4.3
19-21	Simple digital filters	Different LTI systems as frequency selective device.	7.1-7.4
22, 23	Digital Filter design	IIR filter design: IIT, BLT	9
24	Digital Filters	Linear phase FIR filters	7.3
25-28	Digital Filter design	FIR Filter Design	10
29, 30	Digital filter structures	Realization of IIR filters	8.4-8.8
31, 32	Digital filter structures	Realization of FIR filters	8.3, 8.9
33, 34	Finite Word-Length Effects	IIR & FIR Filters	12
35, 36	Multi rate DSP	Decimators & Interpolators	13.1, 13.2
37	Multi rate DSP	Poly phase decomposition	13.3
38	Multi rate DSP	Arbitrary rate sampling rate conversion	13.5
39	Adaptive Digital Filters	Introduction and Concepts of Adaptive filtering, Wiener Filters	RB2 10.1 – 10.3
40	Adaptive algorithms	Basic LMS algorithm	RB210.4
41	Applications of DSP	Various applications	Class note/ Chapter 14
42	Applications of DSP	Various applications	Class note/ Chapter 14

6. Take Home assignments will be announced in the class.

7. Evaluation Scheme:

S. No.	Evaluation Component	Duration Min.	weightage	Date. time, venue	Type
1	Test 1	60	20%	8/9, 8.30-9.30 AM	Closed book
2	Test 2	60	20%	25/10, 8.30-9.30 AM	Closed book
3	Lab	Regular	10%		Open book
4	Lab test		5%		Closed book
4	Assignment		5%		Open book
5	comprehensive	180	40%	12/12 AN	Closed book – 25% Open book – 15%

8. Chamber Consultation Hours: To be announced in the class.

9. Make-up Policy:

Make Up for any component will be given only in genuine cases. In all cases prior intimation must be given to IC.

10. Notices: Notices regarding the course will be displayed on CMS.

Instructor - in - charge

ECE F434

Birla Institute of Technology & Science, Pilani
Hyderabad Campus

SECOND SEMESTER 2017-2018

Course Handout Part II

Date: 07-01-2019

In addition to Part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No.	: ECE F341 / EEE F341/ INSTR F341
Course Title	: Analog Electronics
Credits	: 4
Instructor-in-charge	: R. N. Ponnalagu
Other Instructor	: ---
Tutorial Instructors	: R. N. Ponnalagu and Surya Shankar Dan
Lab Instructors	: R. N. Ponnalagu, Prasant Kumar Pattnaik, Souvik Kundu, P. Joshna, Mary Vallankanni Manik

Scope and Objective of the Course

The aim of the course is to deal with various electronic techniques and building blocks used in analog signal processing applications. Discrete and Integrated electronic circuits will be studied. Experiments and projects using discrete IC modules will be carried out in the laboratory.

Textbooks:

1. TB1 L.K. Maheshwari, Analog Electronics, PHI, 2005
2. TB2 L.K. Maheshwari and M.M.S. Anand, Laboratory Experiments & PSPICE Simulation in Analog Electronics Experiments, PHI, 2005.

Reference books

1. R1. A.S. Sedra, K.C. Smith, Microelectronic Circuits, 5th Ed., Oxford, 2004
2. R2. S. Franco, “Design with Operational Amplifiers and Analog Integrated Circuits”, 3rd Ed. McGraw Hill.
3. R3. Ramakant A. Gayakwad, “Op-Amps and Linear Integrated Circuits”, 4th Ed., 2015, Pearson.

Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
1-2	Key concepts dealing with the basics of circuit theory and electronic devices are reviewed	Introduction & Review of Concepts	TB1 Ch 1
3-6	Introduce the basics of ideal and practical op-amps	Op-amp basics, concept of negative feedback and virtual short, Effect	Class notes and TB1 Ch 2

		of real op-amp parameters on circuit performance	
7-9	Introduce the applications of ideal and practical op-amps in analog electronic systems	Linear applications of op-amps Special purpose Op-amp circuits	Class notes and TB1 Ch 3
10-15	This part discusses the important features and practical realization of active filters. Switched-capacitor filters are also included.	Active filters	Class notes and TB1 Ch 4
16-20	Applications of Op-amps in realization of nonlinear functions such as log and antilog amplifiers, multipliers, dividers are included. Precision circuits, comparators, Schmitt trigger, analog switches, sample-and-hold circuits, analog multipliers, etc. are also introduced.	Non-linear Op-amp circuits	Class notes and R1, TB1 Ch 5
21-27	Sinusoidal and non-sinusoidal signal generators using op-amps and timer ICs are introduced. This part also introduces phase locked loop along with other integrated circuits.	Signal generators, 555 timer based circuits and Phase lock loop	Class notes and TB1 Ch 6
28-31	This part discusses the voltage regulators and also the design of power supply using regulator ICs.	Voltage Regulators	Class notes and TB1 Ch 7
32-34	IC power amplifiers are discussed in this part.	IC Power Amplifiers	TB1 Ch 8
35- 40	This part includes the study of analog-to-digital and digital-to-analog converters. The performance measures and design aspects of data converters will be covered in this part.	A/D and D/A Converters	Class notes and TB1 Ch10, R1 Ch1 0.9-10.11
41-42	IC sensor chips and their applications are elucidated in this part	IC sensors and Analog Systems	Class notes and TB1 Ch 11

Lab Experiments:

S.No	Experiment	Reference to Text
1	Common Emitter Amplifier	TB2 Exp 2
2	Basics Op-amp Configurations	TB2 Exp 6
3	Characterization of Op-amp	TB2 Exp 5
4	Study of Feed Back Amplifiers Using Op-amps	TB2 Exp 8
5	Instrumentation and Programmable Amplifier	TB2 Exp 7
6	Study of Active Filters Using Op-amps Low Pass, High Pass & Band Pass	TB2 Exp 9
7	Precision Circuits	TB2 Exp 12
8	Sinusoidal and Non-Sinusoidal Oscillators	TB2 Exp 15
9	Integrated Circuit Timer & Phase Locked Loop	TB2 Exp 16, Exp 17
10	IC Fixed and adjustable Voltage Regulators	TB2 Exp 19
11	Data Converters (DAC and ADC)	TB2 Exp 24 & 25

Evaluation Scheme:

Component	Duration	Weightage (%) and Marks	Date & Time	Nature of Component
Midsem	1:30 Hours	25% (75)	11/3 1.30 -3.00 PM	Closed Book
Assignments	--	10% (30)	To be uploaded on CMS with notice	Open Book
Quiz	--	15% (45)	To be announced in Class	Open book
Laboratory		20% (60)	Regular practicals and lab test notice will be announced on CMS	Demo / Regular Practicals
Comprehensive	3 Hours	30% (90)	**02/05 FN**	Closed Book
TOTAL		100% (300)		

Chamber Consultation Hour: To be announced in Class

Notices: Notices, if any, concerning the course will be put up on CMS/ EEE Notice Board.

Make-up Policy: There will be no make-ups unless for genuine reasons. i) Prior permission of the instructor-in-charge is required to take a make-up for any component. (ii) Written & signed documentary evidence needs to be furnished by the Hostel Warden/ID confirming the reason for absence from scheduled examination.
Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Dr. R. N. Ponnalagu
INSTRUCTOR-IN-CHARGE

BITS-Pilani, Hyderabad Campus

Second Semester 2015-2016

Course Handout (Part - II)

Date: 12/01/2016

In addition to Part I (General Handout for all courses appended to the Timetable) this portion gives further specific details regarding the course.

Course Number : ECE F418 / EEE F418
Course Title : Modern Communication Technologies
Course Coordinator : **YOGANANDAM Y.**
Instructors :

1. Scope and Objective of the Course:

Modern communication systems overview, Digital modulation techniques, Channel capacity and coding, Digital link improve techniques, Digital receiver design and performance analysis, Wireless communication systems: wireless channel models
and link improvement techniques, multiple access schemes. Basic concept of mobile network, Optical Communication Systems: Transmitters, receivers and other optical Communication subsystem, Optical wireless systems.

The course objectives are:

i) Explain and discuss the essential blocks of a modern communication system.
ii) Formatting and Baseband Modulation:
iii) Discuss Various bandpass modulation and demodulation techniques.
iv) Discuss Link Budget calculations and explain how channel coding helps link improvement.
v) Channel capacity & coding – cursory treatment
vi) Digital receiver design & performance analysis.
vii) Explain Multiplexing & Multiple access techniques.
viii) Explain & discuss wireless channel properties & mitigation techniques.
ix) Introduce mobile communication network concepts.
x) Introduce concepts of optical communication systems.

Course Prerequisite: Prior treatment of Communication Systems (ECE / EEE F311).

2. Text Books:

T1. DIGITAL COMMUNICATIONS Fundamentals and Applications: ERNARD SKLAR and Pabitra Kumar Ray; Pearson Education 2009, 2/e.

T2. Wireless Communications Priniciples and Practice. Theodore Rappaport, Pearson Education

T3. H Kolimbiris “Fiber Optic Communications” Pearson Education, Ist Indian Edition. OR

3. Reference Book (RB):

R1. Communications System Engineering, John G Proakis and Masoud Salehi, Pearson Education, 2002, Second Ed.

R2. Fiber-Optic Communication Systems, Govind P Agarwal, 3rd Edition, Wiley India Edition 2008.

4. Course Plan / Schedule:

Sl. #	Learning objectives	Topics to be covered	Chapter No.	No. of lectures
1.	Introduction	Introduction to the course		1
2.	Explain and discuss the essential blocks of a modern communication system.	Typical block diagram, refresh the nomenclature used in the communication signal processing	T1: Chap 1, Class Notes & R1: Chap 1	1
3.	Formatting and Source Coding	Introduction to types of information to be communicated, formatting, principles and key points for efficient coding	T1: Chap 2,3, Class Notes & R1: Chap 6	2
3.	Baseband Modulation:	Review of Baseband modulation and Demodulation principles, , Detection of signals in Gaussian noise, Matched Filter	T1: Chap 2,3, Class Notes & R1: Chap 6	1
4.	Discuss Various bandpass modulation and demodulation techniques	Digital Bandpass modulation & demodulation techniques, Coherent and non coherent detection, Error performance, M-array signaling & performance and Symbol error performance.	T1: Chap 4 class notes & R1: Chaps 6,7,8,,	2
5.	Discuss Link Budget calculations and explain how channel coding helps link improvement	Link Budget importance, channels, Received signal power, noise power, link budget analysis, Noise figure, Noise temperature, link analysis & system trade offs. How channel coding helps in improving the link performance	Class notes & T1: Chap 5	4
6.	Channel capacity & coding – cursory treatment (as it is being dealt in ECE 393).	Types of channel errors & control, structured sequences, linear block codes, error detection & correction capacity, cyclic codes, Convolution encoder & decoders, properties of convolution codes, RS codes, Turbo coding	T1: Chap 6, 7 & 8 class notes & R1: Chap 9,	8
7.	Digital receiver design & performance analysis.	Shannon-Hartley capacity theorem, bandwidth-Efficiency plane, BW efficiency of different modulation schemes, Modulation & coding trade-offs, Designing digital communication systems, Modulation & coding for Bandwidth limited channels	Class notes & T1: Chap 9	3
8.	Explain Multiplexing & Multiple access techniques.	Allocation of communications resource. FDMA, TDMA, CDMA, Access algorithms, Typical systems discussion	Class notes & T1: Chap 11,	3
9.	Explain & discuss wireless channel properties & mitigation techniques	Communicating over Fading channels, Characterization of wireless channels, Large & small scale fading, Flat & frequency selective fading, Degrading effects due to fading and mitigation, Diversity techniques, Modulation schemes to combat fading and Interleave methods. OFDM, MIMO	T1: Chap 15, Class Notes & T2: Chap 4,5	7
10.	Introduce mobile communication network concepts.	Mobile communications, different standards, Cellular concepts, frequency reuse, Handoff strategies, Interference and system capacity improvements	Class Notes & T2: Chap 1 & 2	4
11.	Introduce concepts of optical communication systems.	Transmitters, receivers and other optical Communication subsystem, Optical wireless systems.	T3: Relevent chapters & Class Notes	3
		Total no. of classes planned		39

5. Evaluation Scheme:

Component	Duration	Weightage	Marks	Date & Time	Remarks
Test I	60 mts.	15%	45	27/2, 8.30 - 9.30AM	Closed Book
Test II	60 mts.	15%	45	11/4, 8.30 - 9.30AM	Closed Book
Surprise Quiz		10%	30		
Term Paper		20%	60		Open book / Take Home
Comprehensive	3 Hrs	40%	120	16/05 AN	Closed Book
Totals		**100%**	**300**		

6. Chamber Consultation Hour: To be announced in Class

7. Make-up Policy: Make-up will be given on extremely genuine grounds only. Prior application should be made for seeking the make-up examination.

8. Notices: Notices, if any, concerning the course will be put up on EEE Notice Board or CMS only.

Instructor-in-Charge
ECE F418 / EEE F418