Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NHS431	**Semester** Even	**Semester IV Session 2018-19** Month from **Jan 2019 – June 2019**
Course Name	HUMAN RESOURCE MANAGEMENT		
Credits	3	**Contact Hours**	2-1-0

Faculty (Names)	**Coordinator(s)**	Dr Kanupriya Mirsa Bakhru
	Teacher(s) (Alphabetically)	Dr Kanupriya Mirsa Bakhru, Dr Praveen Sharma

COURSE OUTCOMES		**COGNITIVE LEVELS**
C207-1.1	Demonstrate a basic understanding of different functions of human resource management: Employer Selection, Training and Learning, Performance Appraisal and Remuneration, Human Relations and Industrial Relations.	Understand Level (C2)
C207-1.2	Apply various tools and techniques in making sound human resource decisions.	Apply level (C3)
C207-1.3	Analyze the key issues related to administering the human resource management activities such as recruitment, selection, training, development, performance appraisal, compensation and industrial relation.	Analyze Level (C4)
C207-1.4	Critically assess and evaluate different human resource & industrial relation practises and techniques and recommend solutions to be followed by the organization	Evaluate Level (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Introduction to Human Resource Management and its definition, HRM functions and its relation to other managerial functions, Nature, Scope and Importance of Human Resource Management in Industry, Role & position of Personnel function in the organization. Human Resource Planning	3
2.	Employer Selection	Recruitment Process; Selection Process - Job and Worker Analyses, Matching Job with the Person; Selection Methods - Application Blank, Biographical Inventories, References and Recommendation Letters, Interviews	8
3.	Training and Learning	Need Identification; Psychological Factors in Learning; Training Methods in the Workplace; Effective Training Programme	6
4.	Performance Appraisal and	Different methods of Performance Appraisal, Basic concepts in wage administration, company's wage policy, Job Evaluation, Issues in wage administration, Bonus &	6

	Remuneration	Incentives	
5.	Human Relations and Industrial Relations, Trends in Human Resource Management	Factors influencing industrial relations - State Interventions and Legal Framework - Role of Trade unions - Collective Bargaining - Workers' participation in management. Trends in Human Resource Management: Analytics, Artificial Intelligence	5
		Total number of Lectures	**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25(Project, Quiz)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	VSP Rao, Human Resource Management: Text and Cases, 2nd Edition , Excel Books, 2002
2.	K. Aswathappa, Human Resource Management: Text and Cases, 8th Edition, Published by Mc Graw-Hill
3.	Dessler, Gary and Varkkey, Biju., Human Resource Management, 14th Edition published by Pearson Education Ltd., 2017

Detailed syllabus
Lecture-wise Breakup

Subject Code	16B1NHS432	**Semester: EVEN**	**Semester** IV **Session** 2018-19 **Month** from Jan 2019 to June 2019
Subject Name	POSITIVE PSYCHOLOGY		
Credits	3	**Contact Hours**	2-1-0
Faculty (Names)	**Coordinator(s)**	Dr. Badri Bajaj	
	Teacher(s) (Alphabetically)	Dr. Badri Bajaj	

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C207-2.1	Demonstrate an understanding of the various perspectives of positive psychology and apply them in day to day life	Apply Level (C3)
C207-2.2	Examine various theories and models of happiness, well-being and mental health	Analyze Level (C4)
C207-2.3	Recommend possible solutions for enhancing happiness, well-being and mental health	Evaluate Level (C5)
C207-2.4	Evaluate interventions/strategies for overall positive functioning	Evaluate Level (C5)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction to Positive Psychology	Overview, Perspectives, Classification and Measures: Human Strengths and Positive Outcomes.	4
2.	Prosocial Behavior	Empathy and Egotism; Altruism, Gratitude, and Forgiveness.	4
3.	Positive Emotions and Wellbeing	Emotional and Cognitive States; Focus on Application: Finding the positive in the Negative; Positive Emotions & Well-Being; Positive Emotions & Flourishing; Flow Experiences	4
4.	Happiness	Happiness and its Traditions; Determinants- Subjective Well-Being Hedonic Basis of Happiness; Life Satisfaction; Self –Realization: The Eudaimonic Basis of Happiness Happiness and Emotional Experiences; Other Facts of Life- Work & Unemployment; Intelligence; Education; and Religion.	4
5.	Mental Health	Mental Health and Behavior; Prevent the Bad and Enhance the Good.	4
6.	Positive Environments	Positive Schooling, Good at Work, Balance Between ME and WE.	4
7.	Living Well	Mindfulness; Contours of a Positive Life:	4

		Meaning & Means; Cultural Context, Every Stage of Life, Resilience, Positive Youth Development, Life Tasks of Adulthood, Successful Aging.	
Total number of Lectures			**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment, Quiz , Oral Questions)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Snyder, C.R., Lopez, S. J., & Pedrotti, J.T. (2011). Positive Psychology: The Scientific and Practical Explorations of Human Strengths. 2nd Ed., Sage Publications
2.	Wesley J. Chun (2014). Positive Psychology, 1st Ed., Pearson
3.	Dewe, P. & Cooper, C. (2012). Well-Being & Work: Towards a Balanced Agenda. Palgrave Macmillian:NY
4.	Vijay Parkash, Updesh Kumar, Archana. (2015). Positive Psychology: Applications in Work, Health and Well – Being. 1st Ed., Pearson

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NHS434	**Semester** : Even	**Semester** IV **Session** 2018 -2019 **Month** from Jan 2019 to June 2019
Course Name	Introduction to Contemporary Form of Literature		
Credits	3	**Contact Hours**	2-1-0

Faculty (Names)	**Coordinator(s)**	Dr. Monali Bhattacharya (Sector 62) Dr. Ekta Srivastava (Sector 128)
	Teacher(s) (Alphabetically)	Dr. Ekta Srivastava , Dr. Monali Bhattacharya

COURSE OUTCOMES		**COGNITIVE LEVELS**
C207-4.1	Interpret & relate with the genres, periods, and conventional as well as experimental forms of literature as current ethical, technological and cultural reflections of society.	Understand Level (C2)
C207-4.2	Apply literary and linguistic theories on the texts to identify them as cultural constructs inculcating human values in the society.	Apply Level (C3)
C207-4.3	Analyze social, cultural, moral and linguistic changes in contemporary world through cloze study of select representative texts of different cultures thematically and stylistically.	Analyse Level (C4)
C207-4.4	Determine the reciprocal relationship between the individual and culture individually and/or through a research based paper/poster presentation with an aim to analyze social, cultural and moral fibre of youth in multidisciplinary environment, giving holistic solutions for sustainable development of society.	Evaluate Level (C5)
C207-4.5	Create literary, non-literary write-up with proper applied grammar usage, having moral and cultural significance for today's world individually and in a team.	Create Level (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introducing Literary Theories	• From Formalism to Reader Response Theory: Major Terms & Concepts • Narrative Art & Narratology • Cultural Studies: An Introduction	6
2.	Introducing New Forms & Sub Genres Today: Features & Portions	• New Fiction: Graphic Novels, Cyberpunk • Non Fiction: Memoirs & Autobiographies, Biographies & Personal Narrative	5
3.	Spiritual Literature	*Siddhartha*- Hermen Hesse (novella)	3
4.	Travel Literature	*Eat, Pray & Love (Book & cinematic adaptation)*	3
5.	Afro American Literature	*Things Fall Apart(Novella)*– Chinua Achebe	3
6.	Commonwealth / Post Colonial	*Hayavadana(Short Play)*- Girish Karnad	3

	Literature		
7.	European Literature:	*The Bloody Chamber & Other Short Stories-* Angela Carter (Short Stories)	2
8	Canadian Literature	*The Penelopiad- Margaret Atwood*	3
		Total number of Lectures	**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment, Presentation , Oral Questions)
Total	**100**

Recommended Reading material:

1.	**Margaret Atwood**, 'The Penelopiad', 1st Edition, Canongate Series, Knopf, Canada, 2005.
2.	**M.H. Abrams**, 'A Glossary of Literary Terms'.7th Edition, Hienle & Hienle: Thomson Learning, USA, 1999.
3.	**Mark William Roche**, 'Why Literature matters in the 21st Century', 1st Edition, Yale University Press, 2004.
4.	**Chinua Achebe**, Things Fall Apart. Reprint . New York: Anchor Books, 1994.
5.	**Angela Carter**, 'The Bloody Chamber & Other Short Stories', 1st Edition, Gollancz, UK, 1979. https://dudley.harvard.edu/files/dudley/files/the_bloody_chamber.pdf
6.	**Hermen Hesse**, 'Siddhartha', 1st Edition. New Directions, US, 1951. For online version: https://www.gutenberg.org
7.	**Elizabeth Gilbert**, 'Eat, Pray & Love. 1st Edition, Penguin,US, 2006.

Detailed Syllabus
Lecture-wise Breakup

Course Code	19B12HS412	**Semester:** Even	**Semester:** IV **Session** 2018 -2019 **Month from:** Jan 2019-June 2019
Course Name	Industrial Economics		
Credits	03	**Contact Hours**	2-1-0

Faculty (Names)	**Coordinator(s)**	Dr. Amba Agarwal
	Teacher(s) (Alphabetically)	Dr. Amba Agarwal

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C207-7.1	Apply the concept of consumer behavior, production, cost and market demand for goods in industry.	Applying Level (C3)
C207-7.2	Evaluate different market structures in respect of price and quantity competition and technological change.	Evaluating Level (C5)
C207-7.3	Analyze the Industrial location and productivity	Analyzing Level (C4)
C207-7.4	Examine industrial profile, industrial proliferation and environmental preservation	Analyzing Level (C4)
C207-7.5	Evaluate the role and types of institutional finance, Regional industrial imbalance & Social Security.	Evaluating Level (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Introduction of Industrial Economics, Framework & Problems; SCP (Structure-Conduct-Performance) Sellers' concentration; Hrfindahl- Hirschman Index.	3
2.	Industrial Organization and Market Structure	Consumer & Producer Surplus; Economies of scale; Cost conditions, Market structure and profitability; Oligopoly theory versus the SCP paradigm.	5
3.	Industrial location and Industrial Productivity	Factors influencing Industrial location and Weber, Florence and Losch theory of industrial location. Measuring Industrial Productivity and Factors influencing Industrial Productivity.	5
4.	Industrial Efficiency	Factors influencing Industrial efficiency & profitability: Internal & External factors, Rostow Stages of Economic Development and Inter-relationship between Industrial Development and Economic Development.	4
5.	Indian Industrial Growth and Pattern	Classification of industries; Industrial policy in India, Issues in industrial proliferation and environmental preservation; Pollution control policies.	3
6.	Industrial Profile and Problems	Structure and Organization of Large Industries in India. Public & Private Sector Enterprises. MSME Role & Problems.	3
7.	Industrial Finance	Role, nature and types of Institutional Finance for industrial development.	2

8.	Industrial Imbalance & Social Security	Regional Industrial Imbalance: Causes and effects of Industrial Imbalances: Measures adopted by Government to reduce regional imbalance & Social Security system provided by Government of India for various industries.	3
Total number of Lectures			**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment, Test, Quiz)
Total	**100**

Recommended Reading material:

1.	**Singh, A. and A.N. Sadhu**, Industrial Economics, Himalaya Publishing House, Bombay,1988
2.	**Barthwal, R.R.**, Industrial Economics, Wiley Eastern Ltd., New Delhi, 1985
3.	**Cherunilam, F**., Industrial Economics : Indian Perspective (3rd Edition), Himalaya Publishing House, Mumbai, 1994
4.	**Ahluwalia, I.J**., Industrial Growth in India, Oxford University Press, New Delhi, 1985
5.	**Hay, D. and D.J. Morris**, Industrial Economics : Theory and Evidence, Oxford University Press, New Delhi, 1979
6.	**Kuchhal, S.C.**, Industrial Economy of India (5th Edition), Chaitanya Publishing House, Allahabad, 1980

Detailed Syllabus
Lecture-wise Breakup

Course Code	19B12HS411	**Semester : Even**	**Semester IV Session** 2018 -2019 **Month from** Jan 2019 to June 2019
Course Name	Market Research & Consumer Behaviour		
Credits	3	**Contact Hours**	2-1-0

Faculty (Names)	**Coordinator(s)**	Dr. Monica Chaudhary
	Teacher(s) (Alphabetically)	Dr. Monica Chaudhary

COURSE OUTCOMES		**COGNITIVE LEVELS**
C207-6.1	Explain the fundamentals concepts used in the study of consumer behaviour.	Remember Level (C1)
C207-6.2	Develop better marketing programs and strategies to influence consumer behaviour.	Apply Level (C3)
C207-6.3	Able to understand the key elements needed for Market Research.	Understand Level (C2)
C207-6.4	Design an effective market research framework.	Apply Level (C3)
C207-6.5	Design a research plan that demonstrates the understanding of Market Research.	Create Level (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Consumer Behaviour and Research	Topic 1: Introduction to Consumer Behaviour Topic 2: Consumer Research Topic 3: Consumer Behaviour and Marketing Strategy	3
2.	Market Research Fundamentals	Topic 1: Market research objective and design Topic 2: Primary data and secondary data Topic 3: Market Research Methods Topic 4: Qualtative & Quantitative Research Design	5
3.	Market Research Data Collection & Analysis	Topic 1: Sampling procedure & Methods Topic 2: Data Analysis	4
4.	Internal Influences on Consumer Behaviour	Topic 1: Motivation and Involvement Topic 2: Personality, Self-Image, and Life Style Topic 3: Consumer Perception & Learning Topic 4: Communication and Consumer Behaviour	6
5.	External Influences on Consumer Behaviour	Topic 1: The Influences of Culture on Consumer Behaviour Topic 2: Subcultures and Consumer Behaviour Topic 3: Social Class and Consumer Behaviour Topic 4: Reference Groups and Family Topic 5: Consumer Influence & the Diffusion of Innovations	3

6.	Consumer Decision Making	Topic 1: Consumer Decision Making-Process Topic 2: Consumer Decision Making-Outcomes Topic 1: Desiging market research Topic 2: Report Writing	4
7.	Market Research Project & Report Writing	Topic 1: Designing market research Topic 2: Report Writing	3
		Total number of Lectures	**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment 1,Assignment 2 and Project)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Schiffman, Consumer Behavior, Global Edition, 10th Edition, Pearson, USA,2014
2.	M.R. Solomon, Consumer Behavior, 7th Edition, Prentice Hall International, 2006.
3.	J. F. Engel, R.D. Blackwell, P.W. Miniard, Consumer Behavior, 8th Edition, The Dryden Press, , 1995
4.	P. Kotler, Marketing Management Analysis: Planning and Control, 9th Edition, Prentice Hall, , 1997

Detailed Syllabus
Lecture-wise Breakup

Course Code	**16B1NHS433**	**Semester Even (specify Odd/Even)**	**Semester Session** 2018 -2019 **Month from Jan-June**
Course Name	Financial Management		
Credits	3	**Contact Hours**	3 (2-1-0)

Faculty (Names)	**Coordinator(s)**	Dr Shirin Alavi (Sector 62) and Dr. Sakshi Varshney (Sector128)
	Teacher(s) (Alphabetically)	1. Dr. Mukta Mani 2. Dr.Sakshi Varshney 3. Dr. Shirin Alavi

COURSE OUTCOMES		**COGNITIVE LEVELS**
C207-3.1	Analyze the techniques of time value of money in taking investment decisions.	Analyze (Level 4)
C207-3.2	Contrast the various forms of business organizations and evaluate their financial performance.	Evaluate (Level 5)
C207-3.3	Evaluate investment projects using capital budgeting techniques	Evaluate (Level 5)
C207-3.4	Apply the concept of cost of capital into evaluation of investment projects	Apply (Level 3)
C207-3.5	Evaluate the leverage capacity of a business and its application in selection of long term sources of finance.	Evaluate (Level 5)
C207-3.6	Understand the practical considerations for managing working capital requirement in a firm.	Understand (Level 2)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Basic financial concepts-Meaning of Accounting, Accounting Concepts and Conventions, Introduction to Double Entry system and Accounting equation, Definition and Objectives of Financial management,	2
2.	Time value of Money	Compounding, Discounting, Annuity, Perpetuity, Loan Amortization	3
3.	Analysis of Financial Statements	Understanding of Balance Sheet and Income Statements, Ratio Analysis, Interpretation, Importance and limitations	4
4.	Capital Budgeting: Principle Techniques	Nature of Capital Budgeting, Evaluation Techniques: Discounting (NPV, IRR etc.) and Non-discounting Techniques (payback, ARR etc)	4
5.	Long Term Sources of Finance	Definition, types, advantages and disadvantages	4
6.	Concept and measurement of cost of capital	Definition, measurement of specific costs, computation of Overall Cost of Capital,	4
7.	Cash Flows for Capital Budgeting	Identification and determination of relevant cash flows	3
8.	Leverages and Capital structure decision and Working Capital Management	Break Even Analysis, Operating, Financial and combined leverage, Capital structure EBIT- EPS analysis, Concept of working capital management, Practical Considerations in Working capital management	4

		Total number of Lectures	**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Test 1 + Test 2+Project)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Khan, M.Y. and Jain, P.K., *Financial Management: Text, Problems and Cases*, 5th ed, Tata McGraw Hill, 2007.
2.	Chandra, P., *Financial Management Theory and Practice*, 6th ed., Tata McGraw Hill, 2004.
3.	Pandey, I.M., *Financial management*, 9th ed, Vikas Publishing House Pvt Ltd, 2006
4.	Van Horne, J.C. and Wachowicz, J.M., *Fundamentals of Financial Management*, 11th ed, Pearson Education, 2001
5.	Kishore, R.M., *Financial Management*, 6th ed, Taxmann, 2007.

Detailed Syllabus
Lecture-wise Breakup

Subject Code	**16B1NHS435**	**Semester : EVEN**	**Semester: IV Session: 2018-19** **Month: January2018 to June2018**
Subject Name	**SOCIOLOGY OF MEDIA**		
Credits	**3**	**Contact Hours**	**(2-1-0)**

Faculty (Names)	**Coordinator(s)**	**Prof. Alka Sharma**
	Teacher(s) (Alphabetically)	**Prof Alka Sharma** **Ms Shikha**

CO Code	COURSE OUTCOMES	COGNITIVE LEVELS
C207-5.1	Demonstrate a basic understanding of different methods and concepts used in the systematic study of Sociology of Media	Understanding(C 2)
C207-5.2	Examine various tools and techniques used and gain theoretical orientation towards media and society.	Analyzing(C 4)
C207-5.3	Analyze the key issues related to the processes of Production of Media, Popular Culture and consumer culture.	Analyzing(C 4)
C207-5.4	Critically evaluate the major methods of Cultural Consumption ,Social Class & the process of construction of subjectivities and audience reception in new Media	Evaluating(C 5)
C207-5.5	Create positive and critical attitude towards the use of new media and understanding of threats of Digital Age	Creating(C 6)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction	Introduction to the Course	1
2.	Theoretical Orientation	• Functionalist Approach to the Sociology of Media and Popular Culture • Critical Approach to the Sociology of Media and Popular Culture • Symbolic Interactionist Approach to the Sociology of Media and Popular Culture	4
3.	Popular Culture	• What is popular culture? • Difference between 'pop' culture and 'high' culture • What distinguishes popular culture from other kinds of culture (art, folk culture)? Is there a distinction at all anymore? • Visualizing Society through 'pop' culture/ media • Risks and rituals that come with Popular Culture	5
4.	New media	• Difference between tradition media and new media • New media as technology • New Information Technology (brief history in case of India)	3
5.		• Mediatization of Society • Free-speech Media	3

	Media & State		
6.	Consumption of Media and Media reception	• Social Actors as Audience/ Audience as market– Theory • Media effects: Media and representations (gender, ethnic)- the under-representation and misrepresentation of subordinate groups. • Media and the construction of reality: media logic and cultivation analysis theory • Information Society vs Informed Society • Cultural Consumption and Social Class	7
7.	Media in Global Age	• Rise of Network Society- Manuel Castells • Global Media: impact of market & state • Global Perspectives: The world on our doorstep • Marketing and aesthetics in everyday life	5
		Total number of Lectures	**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project, Presentation and attendance)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	JosephTurow, *Media Today: An Introduction to Mass Communication*,3rd Ed., Taylor & Francis. UK. (2008).
2.	JA Fisher 'High Art v/s Low Art, in Berys Nigel Gaut& Dominic Lopes (eds.), *The Routledge Companion to Aesthetics*. Routledge2001
3.	G.Ritzer, 'McDonaldization of Society,. *The Journal of American Culture*. Volume 6, Issue 1. (2001 [1983])Pp. 100-107.
4.	Manuel. Castells,'Introduction', in *Rise of Network Society: The Information Age: Economy, Society and Culture*, 2nd Ed (1996).

Detailed Syllabus
Lecture-wise Breakup

Course Code	15B11EC411	**Semester** EVEN **(specify Odd/Even)**	**Semester** 4th **Session** 2018 -2019 **Month from** Jan to May
Course Name	ANALOGUE ELECTRONICS		
Credits	4	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Dr. Hemant Kumar, Dr. Vivek Dwivedi
	Teacher(s) (Alphabetically)	Dr. Archana Pandey , Mr. Ajay Kumar, Mr. Varun Goel

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Classify the different modes of operation of a transistor and stability analysis of a transistor.	Understanding (Level II)
CO2	Explain and analyze the various BJT and MOS amplifier circuits for different frequency ranges.	Analyzing (Level IV)
CO3	List and explain the building blocks of an Op-Amp and its characteristics.	Understanding (Level II)
CO4	Explain the effect of feedback on amplifier characteristics and design of various types of oscillators.	Evaluating (Level V)
CO5	Apply basic understanding of Op-Amp to design various electronics circuits for specified gain and waveform.	Applying (Level III)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	BJT Amplifier	Single stage (CE, CB, CC), Small-Signal Model, Multistage: CE-CE, Darlington-pair, and Cascode, Frequency Response of CE Amplifier	10
2.	Introduction of MOSFET and analysis of MOS amplifier	Introduction of MOSFET, characteristics and basing (voltage and current), small signal models: common source, common gate and common Drain, Frequency Response of CS amplifier	8
4.	Building Blocks of Op-Amp	Basic building block of Op-Amp, Differential amplifiers, Analysis of Differential Amplifiers, Current Mirrors	9
5.	Feedback	Four basic feedback topologies: series-shunt, series-series, shunt-shunt, shunt-series, Introduction and Criterion for oscillations	5
6.	Measurement of Op-Amp Parameters	Output Offset Voltage, Input offset voltage, Input Bias Current, Input Offset current, CMRR, Slew rate, Open loop and closed loop gain, PSRR.	3
7.	Application of Op-Amp	Half wave rectifier, Full wave rectifier, Comparators, Zero Crossing Detector, Peak Detector, Log and Antilog Amplifiers, Voltage multipliers, Schmitt trigger, Waveform generator (square wave, triangular wave), Instrumentation amplifier.	7

Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	A.S .Sedra & K.C.Smith, Microelectronic CIRCUITS Theory and Application, 6th Edition, Oxford University Press, 2011
2.	J.Milman & Halkias : Integrated Electronics, 2nd Edition, Tata McGraw Hill, 1991.
3.	R.A. Gayakwad: Op Amp and Linear Integrated Circuit Technology, 3rd Edition, Prentice-Hall India, 1999.

Detailed Syllabus
Lecture-wise Breakup

Course Code	15B11EC412	**Semester** Even **(specify Odd/Even)**	**Semester** IV **Session** 2018 -2019 **Month from** January to June
Course Name	Analogue Communications		
Credits	4	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Dr. Atul Kumar, Ms. Shradha Saxena
	Teacher(s) (Alphabetically)	Dr. Juhi Gupta, Mr. Raghvendra Singh, Dr. Rahul Gupta, Dr. Yogesh Kumar

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Identify the key elements of Communication system and various analog modulation techniques involved.	Understanding (Level II)
CO2	Differentiate among various amplitude modulation schemes and design simple systems for generating and demodulating amplitude modulated signals.	Applying (Level III)
CO3	Analyze the generation and detection of FM signal and design basic systems for the indirect and direct generation of FM signals.	Analyzing (Level IV)
CO4	Design different radio receiver circuits and evaluate the signal to noise ratio and figure of merit of various modulation techniques.	Evaluating (Level V)
CO5	Understand the different pulse modulation and demodulation techniques and the concept of sampling and multiplexing.	Understanding (Level II)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Review of Fourier transforms; Elements of a communication system; Analog and digital signals, bandlimited signals and systems	3
2.	Analog modulation systems	Introduction to modulation; AMSC, DSB, VSB Communication. Detection of AM signals: Coherent detection, Envelope detection, Costas receiver, S/N ratio in AM systems, Threshold effect	10
3.	Angle modulation	Concepts of FM and PM, Narrowband and wideband FM, Direct and indirect methods of FM generation, Detection of FM signals, PLL(Linear & Non Model):Analysis and applications, S/N of FM systems	12
4.	Transmitters and Receivers	AM and FM transmitters, TRF, Superhetrodyne AM and FM receivers, AGC, Double Detection, Double Spotting	4
5.	Pulse modulation techniques	Time and Frequency domain sampling with aperture effects, Reconstruction of signals, PAM and PPM generation, Application and detection; synchronous and asynchronous	7
6.	Multiplexing	FDM,TDM, Interchannel crosstalk and bandwidth effects	4
		Total number of Lectures	**40**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Tutorial marks, Attendance, Class performance, Assignment, Quiz)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	LATHI, B.P, Modern Digital and Analog Communication Systems, Oxford University Press, 3rd edition, 2005
2.	H. Taub, Donald L. Schilling and G. Saha, Principles of Communication Systems, TMH, 3rd edition, 2008
3.	S. Haykin, Communication Systems, John Wiley & Sons, Intl. Ed, 2004
4.	Carlson , Communication systems, Macgraw hill

Detailed Syllabus
Lecture-wise Breakup

Course Code	15B11EC413	**Semester Even 2019 (specify Odd/Even)**	**Semester IV Session January** 2019 – May 2019 **Month from Januray**
Course Name	DIGITAL SIGNAL PROCESSING		
Credits	4	**Contact Hours**	**4**

Faculty (Names)	**Coordinator(s)**	Dr. Madhu Jain,
	Teacher(s) (Alphabetically)	Ms. Smriti Bhatnagar, Dr. Vineet Khandelwal,

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Recall the principles of z-transforms, explain the DFTs (Discrete Fourier Transform) and develop FFT (Fast Fourier Transform) algorithms for DFT.	Applying (Level III)
CO2	Construct and Analyze the digital FIR (Finite Impulse Response) and IIR (Infinite Impulse Response) filters.	Analyzing (IV)
CO3	Demonstrate multi-rate signal processing and relate DSP (Digital Signal Processing) in various applications.	Understanding (Level II)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Review of Discrete time Signals and Systems**	Review of discrete–time sequences and systems, Discrete time system analysis using Z transform.	3
2.	**Discrete Fourier Transform and FFT**	Discrete Fourier Transform (DFT) and its properties, Linear filtering methods based on DFT, Frequency analysis of signals using the DFT, Fast Fourier Transform (FFT) algorithms using decimation in time and decimation in frequency techniques.	11
3.	**FIR Filter design**	Basic structures of digital filters; Significance of Linear phase response, FIR filters design - Frequency sampling and Windowing techniques, Computer aided design.	8
4.	**IIR Filter design**	Approximation of filter functions: Butterworth, Chebyshev, Elliptic; IIR filter design based on analog filter functions- Impulse Invariant and modified invariant response techniques, Bilinear transformation method.	10
5.	**Multi-rate Digital**	Decimation & Interpolation, Filter design with sampling	5

	Signal Processing	rate conversion, by a rational factor I/D	
6.	**DSP Applications**	Applications in speech and image processing, and power spectrum estimation.	7
		Total number of Lectures	44

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	L. Tan, Digital Signal Processing Fundamentals and Applications, Academic Press, 2008.
2.	J. G. Proakis & D. G. Manolakis, Digital Signal Processing, Principles, Algorithms and Applications, Fourth edition, PHI, 2007.
3.	S. K. Mitra, Digital Signal Processing: A Computer Based Approach, Third Edition, *TMH*, 2006.
4.	L. R. Rabiner, B. Gold, Theory and application of digital signal processing, PHI, 2012
5.	A. Antoniou, Digital Signal Processing: Signals, Systems, and Filters, TMH, 2006

Detailed Syllabus

Lecture-wise Breakup

Subject Code	15B11EC414	**Semester Even (specify Odd/Even)**	**Semester** 4th **Session** 2018-19 **Month from** January **to** June
Subject Name	VLSI TECHNOLOGY AND APPLICATIONS		
Credits	4	**Contact Hours**	4
Faculty (Names)	**Coordinator(s)**	1. Satyendra Kumar, 2. Ekta Goel	
	Teacher(s) (Alphabetically)	Amit Kumar Goyal, Deeksha Chandola, Garima Kapur, Priyanka Kwatra, Saurabh Chaturvedi	

S. No.	Course Outcomes	Cognitive levels/Blooms taxonomy
CO1	Telling VLSI design flow, different VLSI design styles, Showing Front End modeling of digital systems using Verilog-HDL	Remembering (Level I)
CO2	To demonstrate the operation of MOSFET. To explain the technology scaling and its effects. To illustrate the basics of fabrication and layout design of CMOS circuits	Understanding (Level II)
CO3	To develop the concepts of MOS inverters by studying their static and switching characteristics. To build the MOS inverters with different design constraints	Applying (Level III)
CO4	To analyze combinational and sequential logic circuits. To demonstrate the working principle of different types of semiconductor memories	Analyzing (Level IV)

Module No.	Subtitle of the Module	Topics in the Module	No. of Lectures
1.	Introduction to VLSI	Overview of VLSI design methodologies, VLSI design flow, Design hierarchy, VLSI design styles.	3
2.	MOS transistor theory	MOS structure and operation, MOSFET I-V characteristics, Scaling and small-geometry effects, MOSFET capacitances, MOSFET models for circuit simulation	8
3.	Fabrication of MOSFETs	Fabrication process flow, CMOS n-well process, Twin tub process	3
4.	MOS inverters	Static and switching characteristics, Delay-time definitions, calculation of delay times, Inverter design with delay constraints,	6

		Static and switching power dissipation of CMOS inverter, Interconnect delay Models	
5.	MOS logic circuits	CMOS logic circuits, Complex logic circuits, Pass transistor logic, CMOS transmission gates, Sequential logic circuits, Dynamic logic circuits, Stick diagram, Layout, Layout design rules and DRC	12
6.	System specification using HDL	Language fundamentals, Different modeling techniques using Verilog-HDL	5
7.	Semiconductor memories	DRAM, SRAM, ROM	3
8.	FPGA fundamentals and basic architectures	Evolution, application, implementation, programming technology	2
		Total number of Lectures	42

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25(10 – attendance, 10 - Quiz/Assignment/tutorial, 5 -Class performance)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Sung-Mo Kang, Yusuf Leblebici, "CMOS Digital Integrated Circuits: Analysis and Design", 3rd Edition, Tata McGraw-Hill Publication, 2003.
2.	J. M. Rabaey, A. Chandrakasan, B. Nikolic, "Digital Integrated Circuits: A Design Perspective", 2nd Edition, Pearson Education Inc., 2003.
3.	Neil Weste and David Harris, "CMOS VLSI Design: A Circuits and Systems Perspective", 3rd Edition, Addison Wesley, 2005.
4.	Samir Palnitkar, "Verilog HDL: "A Guide to Digital Design and Synthesis", Pearson Education Inc., 2nd Edition, 2004.

Detailed Syllabus
Lab-wise Breakup

Course Code	15B17EC471	**Semester : Even (specify Odd/Even)**	**Semester** IVth **Session** 2018-2019 **Month from** Jan – June 2019
Course Name	Analogue Electronics Lab		
Credits	**1**	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	Kirmender Singh
	Teacher(s) (Alphabetically)	1. Ajay Kumar 2. Archana Pandey 3. Ekta Goel 4. Garima Kapur 5. Shivaji Tyagi 6. Saurabh Chaturvedi

COURSE OUTCOMES	DESCRIPTION	COGNITIVE LEVELS
CO275.1	Plot the transient, frequency response of second-order RC circuit using SPICE/MULTISIM and utilize the plot to compare 3-dB cut-off frequency with theoretical calculation.	Applying (Level III)
CO275.2	Analyze the bias point and plot frequency response of single-stage amplifiers and they will be able to build an amplifier of given specifications.	Analyzing (Level IV)
CO275.3	Build a common-source amplifier for a specified gain using N-channel MOSFET.	Applying (Level III)
CO275.4	Analyze BJT based simple constant current biasing circuit and subsequently improves its specification by using modified current mirror.	Analyzing (Level IV)
CO275.5	Determine differential gain, common mode gain and CMRR of BJT based differential amplifier.	Applying (Level III)
CO275.6	Simulate an operational amplifier and use it in different applications.	Analyzing (Level IV)

Module No.	Title of the Module	List of Experiments	CO
1.	Introduction and demonstration of Simulation tool with suitable example	Installation of PSPICE Light version/MULTISIM tool on GPL with operating instructions. Simulate transient and frequency response of first-order RC circuit for input of sine and square waveform.	**CO275.1**
2.	Study and Analyzing Biasing Techniques	a) Use PSPICE/MULTISIM to simulate dependence of β_{dc} on collector bias current for discrete BJT transistor (BC547B/ 2N2222A/3904). b) To compare the biasing techniques such as voltage divider, collector to base bias and fixed bias for DC "Q- point" stability of a BJT (BC547B/2N2222A/3904) on PSPICE/MULTISIM and verify it on bread board.	**CO275.2**
3.	Large signal and small signal analysis	Use PSPICE/MULTISIM to determine instantaneous node voltages and branch currents of single stage CE amplifier for	**CO275.2**

	of CE amplifier	triangular input V_i = 1.6V (p-p) using discrete transistor (BC547B/2N2222A/3904). Also determine the maximum amplitude of V_i which is allowed to be used in the amplifier.	
4.	Large signal and small signal analysis of CE amplifier	Experimentally verify instantaneous node voltages and branch currents of CE amplifier of Exp. 3 on bread board.	**CO275.2**
5.	Frequency Response of Amplifier	Simulate frequency response of CE amplifier using ±5V power supply. Determine a) Upper, lower 3-dB frequency b) Bandwidth and observe the change in bandwidth with increase and decrease in value of bypass capacitor.	**CO275.2**
6	Design of BJT based amplifier	Design a single stage BJT amplifier for given specifications.	**CO275.2**
7.	Frequency Response of Amplifier	Simulate frequency response of the Common source amplifier using N- channel MOSFET BS170. Determine a) Upper, lower 3-dB frequency b) Bandwidth	**CO275.3**
8.	Design of MOS based amplifier	Design a single stage MOS amplifier for given specifications.	**CO275.3**
9.	Current Mirror	Design a basic BJT current mirror using discrete transistor (BC547B/2N2222A/3904) for reference current of 1mA. Determine the output resistance, current gain error.	**CO275.4**
10.	Current Mirror	Experimentally verify Exp. 9 on bread board.	**CO275.4**
11.	Current Mirror	Design Wilson current mirror of 1mA and determine the output resistance, current gain error.	**CO275.4**
12.*	Differential Amplifier	Simulate the single stage differential amplifier and determine the following: a) Frequency response of differential gain A_d. b) Frequency response of common mode gain $A_{CM.}$ c) Common Mode Rejection Ratio (CMRR).	**CO275.5**
13.*	Open loop operational Amplifier	Simulate the BJT based operational amplifier circuit (OP-AMP) and determine the bias point, small signal differential gain, common mode gain A_{CM}, and CMRR.	**CO275.**6
14.*	Sub circuit model of OP-AMP	An op-amp with differential resistance of 20KΩ, dc gain of 8513 and an output resistance of 75Ω. Create a sub circuit model/block for this op-amp in PSPICE/MULTISIM.	**CO275.**6
15.*	Applications of OP-AMP	Simulate the closed–loop non inverting amplifier, inverting amplifier, adder, subtractor of given specifications and determine: a) Transient Response b) Its 3-dB bandwidth c) Input resistance R_i	**CO275.**6

Evaluation Criteria

Components	**Maximum Marks**
Viva1	20
Viva2	20
Day to Day performance	60
Total	**100**

*** These are advanced level experiments.**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	A.S .Sedra & K.C.Smith, Microelectronic Circuits Theory and Application, 6th Edition, Oxford University Press, 2015(Text Book)
2.	Marc Thompson, Intuitive Analog Circuit Design, 2nd Edition, Elsevier Publication, 2013

Detailed Syllabus
Lab-wise Breakup

Course Code	15B17EC472	**Semester EVEN (specify Odd/Even)**	**Semester** IV **Session** 2018 -2019 **Month from January 2019**
Course Name	Analog Communication Lab		
Credits	1	**Contact Hours**	**2**

Faculty (Names)	**Coordinator(s)**	Dr. Yogesh Kumar and Dr. Bhawna Gupta
	Teacher(s) (Alphabetically)	Dr. Atul Kumar, Mr. Raghvendra Kumar, and Prof. Shweta Srivastava

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Learning about CRO functioning, Function Analyzer, bread board, and circuit connection. Study of amplitude modulation and demodulation, and frequency modulation using various circuits and MATLAB Simulation.	Understanding (Level II)
CO2	Perform amplitude modulation and Double side band suppressed carrier modulation using IC AD633 and MATLAB & calculate modulation index for various modulating signals and study the over, exact and under modulation. Perform demodulation of AM signal using envelope detector	Analyzing (Level IV)
CO3	Study of Frequency modulation (FM), Phase Lock Loop (PLL). Study of different Pulse modulation and sample and hold circuits.	Understanding (Level II)
CO4	Determining the performance parameters in frequency modulation using IC XR2206, IC AD633, and IC 565. Design a Pulse Position Modulation (PPM), PWM sampling using IC-555 Timer IC LF398, Frequency mixer and ring modulator respectively.	Analyzing (Level IV)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Functional setup and Amplitude modulation	Implement amplitude modulation circuit using IC AD633 & calculate modulation index for various modulating signals and study the over, exact and under modulation.	CO1,2
2.	Double side band modulation	Implement DSB-SC modulation using IC AD633.	CO2
3.	Double side band demodulation	Implementation of DSB SC Demodulation using synchronous detector.	CO2
4.	Amplitude demodulation	To study envelope detector for AM signal and observe peak diagonal clipping effect.	CO2
5.	Frequency Modulation	Design a Frequency modulation (FM) circuit using IC XR2206 and determine the frequency deviation and modulation index	CO3,4
6.	Different modulation technique PWM	To Design a Pulse width modulation (PWM) Circuit using IC 555 timer and Modulate the width of pulse train from 10% to 90%. / Implement DSB-SC modulation using ring modulator	CO4
7.	Different modulation technique PPM	To design a Pulse Position Modulation (PPM) using IC-555 Timer/ To design a frequency mixer circuit using IC AD633.	CO4
8.	Frequency Demodulation	Design circuit using IC 565 for determining the free running frequency, lock range and capture range of a PLL.	CO4

9.	Sampling	Design a circuit to sample the analog signal using IC LF398 and reconstruct it.	CO4
10.	Amplitude modulation	Implementation of amplitude modulation using MATLAB.	CO2
11.	Frequency modulation	Implementation of frequency modulation using MATLAB.	CO2

Evaluation Criteria

Components	**Maximum Marks**
1. Viva-1	20
2. Viva-2	20
3. D2D	60
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Simon Haykin, An Introduction to Analog and Digital Communications, 2010 (Reference Book)
2.	Rudra Pratap, Getting Started with MATLAB: A Quick Introduction for Scientists & Engineers, 2010 (text book)

Detailed Syllabus
Lab-wise Breakup

Course Code	15B17EC473	**Semester** … **Even**	**Semester** 4th **Session** 2018 -2019 **Month from (**January - May)
Course Name	Digital Signal Processing Lab		
Credits	1	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	Dr. Parul Arora, Dr. Vineet Khandelwal
	Teacher(s) (Alphabetically)	Mr. Abhay Kumar, Dr. Bajrang Bansal, Ms. Jyoti Vyas, Dr. Kuldeep Baderia

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Recall and interpret discrete time signals and systems in time domain and in frequency domain	Understanding (Level II)
CO2	Develop and demonstrate coding skills from basic mathematical operations to complex operations like DFT and FFT.	Applying (Level III)
CO3	Identify and examine different digital filter structures.	Analyzing (Level IV)
CO4	Determine and observe magnitude and phase characteristics (Frequency response Characteristics) of digital IIR-Butterworth, Chebyshev filters and digital FIR filters using window techniques for various applications of DSP.	Evaluating (Level V)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Introduction to Matlab	Introduction to MATLAB and its various applications.	1
2.	Study of time domain analysis	Generation of discrete time and continuous-time signal with different operation on them.	1
		Write your own MATLAB function to implement linear convolution as an operation to analyze discrete time LTI system.	1
3.	Study of Frequency domain analysis	Write your own MATLAB function to compute DFT (Discrete Fourier Transform) and IDFT (Inverse Discrete Fourier Transform) for the spectral analysis of signals.	2
		Compute z- transform and inverse z-transform of a discrete time signals and systems. Plot pole-zero map of the same using symbolic tool box.	1
		Write your own MATLAB function 'mycirconv' to compute circular convolution of two sequences.	2
		Develop radix-2 butterfly FFT (Decimation in Time) algorithm for the computation of N-point dft.	2
4.	Analysis of Filter deisgning	Write MATLAB program to design digital FIR filter employing windowing technique.	4
		Write MATLAB program to design IIR digital filter for a given specification using bilinear transformation and impulse invariant method.	4
		Write MATLAB program for realization of digital IIR filter using direct form-I & II, cascade and parallel method.	3

		Virtual Lab: Study of FIR filter design using window method.	4
		Virtual Lab: Study of Infinite Impulse Response (IIR) filter.	4

Evaluation Criteria

Components	**Maximum Marks**
V1	20
V2	20
AC	40
Attendance	10
Virtual Lab Exp	10
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Sanjit K. Mitra, Digital Signal Processing: With DSP Laboratory Using MATLAB : A Computer-Based Approach*, Second Revised Edition, TMH,* 2001.
2.	Vinay K. Ingle, John G. Proakis, Digital Signal Processing Using MATLAB, *Third Edition, Cengage Learning,* 2012.

Detailed Syllabus
Lab-wise Breakup

Course Code	15B17EC474	**Semester** Even	**Semester** IV **Session** 2018-2019 **Month from** January to May
Course Name	VLSI Lab		
Credits	1	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	Saurabh Chaturvedi, Priyanka Kwatra
	Teacher(s) (Alphabetically)	Amit Goyal, Garima Kapur, Mandeep Narula, Rachna Singh

COURSE OUTCOMES - At the end of the course, students will be able to:		**COGNITIVE LEVELS**
CO1	-Relate the concepts of basic electronics circuits and recall the use/working of circuit simulation tools	Remembering (Level I)
CO2	-Understand and explain the current-voltage characteristics of NMOS and PMOS transistors and extraction of MOSFET parameters	Understanding (Level II)
CO3	-Apply the MOSFET theory in MOS-based circuits, e.g. MOS inverters, combinational and sequential MOS logic circuits	Applying (Level III)
CO4	-Analyze the static and switching characteristics of MOS inverters and examine the delay times -Analyze and simulate the schematic and layout of CMOS combinational and sequential logic circuits and examine their responses	Analyzing (Level IV)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Introduction to CAD/EDA tool	Introduction to Tanner tools: T-Spice, S-Edit and L-Edit.	CO1
2.	MOS transistors	To study the I-V characteristics of NMOS and PMOS transistors. To obtain the MOSFET parameters: k_n, v_{to}, v_t, γ and λ.	CO2
3.	MOS inverters	To analyze the voltage transfer characteristics (VTC) of resistive-load NMOS inverter and then calculate V_{OH}, V_{OL}, V_{IH}, V_{IL} and V_{th}. Experiments related to CMOS inverter: -Simulation of CMOS inverter with arbitrary value of W/L -Analysis of VTC -Observe the effect on VTC by changing the W/L of NMOS and PMOS transistors -Observe the effect on VTC by changing the supply voltage	CO3
4.	MOS combinational and sequential logic circuits	To analyze and calculate the propagation delay, rise time and fall time of a CMOS inverter. Simulate the logic gates and verify the truth tables: Two-input NAND, two-input NOR Simulation of a logic circuit with the given Boolean expression.	CO4

		Layout design and simulation of NMOS and PMOS transistors. Layout design and simulation of a CMOS inverter. Layout design and simulation of CMOS logic gates. Layout design and simulation of CMOS transmission gates. Implementation of a two-input XOR gate using CMOS transmission gates. Implementation of a two-input multiplexer using CMOS transmission gates. Implementation of a CMOS D-latch.	

Evaluation Criteria

Components	**Maximum Marks**
Mid-semester viva	20
End-semester viva	20
Day-to-day performance (Lab record, experiment performance, discipline etc.)	60
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	S.-M. Kang and Y. Leblebici, "CMOS digital integrated circuits: Analysis and design," 3rd edition, Tata McGraw-Hill, 2003.
2.	N. H. E. Weste and D. M. Harris, "CMOS VLSI design: A circuits and systems perspective," 3rd edition, Addison-Wesley, 2005.