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## K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BENGALURU - 560109 DEPARTMENT OF BASIC SCIENCE

SESSION: 2021-2022 (EVEN SEMESTER)

### **CO-PO MAPPING**

Course Title: Engineering Physics										
Course True: Engineering Physics     Course Code:21PHY22       Type: Fundamental     No of Hours										
No of Hours										
	Theory	ry Practical/Field Work/Allied Total hours/Week Total teac				ching hours				
(Lec	cture Class)		Activities		4		40			
	4 U 4 Ho									
Inter	That Assessment Examination Total Credits						Credits			
milei	50		50		100 3					
Aim/	Aim/Objectives of the Course									
1. E P 2. L er 3. G te	<ol> <li>Engineering Physics is one of a basic subject for all engineering course. In this course, principles of Physics are taught to build strong foundation of knowledge required for engineering courses.</li> <li>Learning the basic concepts in Physics which are very much essential in understanding and solving engineering related challenges.</li> <li>Gaining the knowledge of newer concepts in modern physics for the better appreciation of modern technology.</li> </ol>									
After	completing th	e co	urse, the students will be a	ble to						
C01	CO1 Utilizing the knowledge of simple harmonic motion, derive the expressions for various types of oscillations and to understand the role of shock waves in various fields.									
CO2	Understand modern tech	the nolo	principles of lasers, optica ogy.	tical fibers and Applying its applications in Applying (K3)						
CO3	Apply the theory of modern physics to explain the principles of quantum mechanics, to set up one-dimensional Schrodinger's wave equation and its Applying (Kapplying)									
CO4	<b>Determine</b> the various electrical and thermal properties of materials like Applying (Ferrare Conductors, semiconductors and dielectrics using different theoretical models.									
C05	Interpret th	e ap	plication of sensitive instru	imentatio	on for Nano-scale	system.	Applying (K3)			
			Syllal	bus Con	tent					
Made	le 1. Ossillet	and	and Wayes				CO1			
Oscilla harmo	ations: Basics nic oscillators	of S (spi	HM, derivation of equation ring constant by series and	n for SH	M, Mechanical sin combination), Eq	mple uation of	10 hrs			
motion	for free oscil	latio	ons, Natural frequency of o	scillation	ıs.		PO1-3			
Dampe	ed Oscillation	s: Tl	heory of damped oscillation	ns (deriv	ation), over damp	ing, critical	PO2-2			
& und	erdamping (gi	aph	ical representation), quality	y factor.			PO4-1			

Forced Oscillations: Theory of forced oscillations (derivation) and resonance, sharpness	PO6-2
of resonance	PO7-2
Shock waves: Mach number Properties of Shock waves Construction and working of	PO12 -1
Reddy shock tube	PSO1-3
LO: At the end of this module, the students will be able to	PSO2-1
1. Explain SHM and different types of oscillations.	
2. Derive the expressions for amplitude of damped and forced vibrations.	
3. Explain Mach number, classification based on Mach number and Reddy shock	
tube.	

Module	2:
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<ul> <li>Lasers &amp; Optical Fibers         <ul> <li>Lasers: Interaction of radiation with matter, Einstein's coefficients (derivation of expression for energy density). Requisites of a Laser system. Conditions for Laser action. Principle, Construction, and working of CO2 and semiconductor Lasers. Application of Lasers in Defence (Laser range finder) and medical applications-Eye surgery and skin treatment.</li> </ul> </li> <li>Optical Fibers: Propagation mechanism, angle of acceptance, Numerical aperture, Modes of propagation, Types of optical fibers, Attenuation, and Mention of expression for attenuation coefficient. Discussion of a block diagram of point-to-point communication, Optical fiber sensors- Intensity-based displacement sensor and Temperature sensor based on phase modulation, Merits, and demerits, Numerical problems.</li> <li>LO: At the end of this module, the students will be able to         <ol> <li>Derive the expression for energy density in terms of Einstein's Coefficients.</li> <li>Explain the construction and working of different types of lasers and its applications.</li> <li>Explain the mechanism of optical fiber and attenuation. Explain the different types of optical fibers and its applications.</li> </ol> </li> </ul>	CO2 10 hrs PO1-3 PO2-2 PO4-2 PO4-2 PO6-2 PO7-3 PO12-1 PSO1-3 PSO2-1
Module 3: Modern Physics and Quantum Mechanics	
Introduction to blackbody radiation spectrum- Wien's law, Rayleigh Jean's law, Stefan - Boltzmann law and Planck's law (qualitative), Deduction of Wien's law, and Rayleigh Jeans law from Planck's law. Wave-Particle dualism, de-Broglie hypothesis, de-Broglie wavelength. Heisenberg's uncertainty principle and its physical significance, Application of uncertainty principle (Non-existence of electron in the nucleus), Wave function- Properties, Physical significance, Probability density, Normalization, Eigenvalues and Eigen functions. Time independent Schrödinger wave equation. Particle in a box- Energy Eigenvalues and probability densities, Numerical problems.	CO3 10 hrs. PO1-3 PO2-3 PO4-3 PO4-3
<ol> <li>LO: At the end of this module, the students will be able to         <ol> <li>Explain the blackbody radiation spectrum based on Planck's law.</li> <li>Explain the uncertainty principle and its applications.</li> <li>Obtain the expression for time independent Schrodinger wave equation, energy Eigen values and Eigen functions.</li> </ol> </li> </ol>	PO6-3 PO7-1 PO12-1 PSO1-3 PSO2-2

Module 4: Electrical Conductivity in Solide	
Classical free electron theory: Esse electron concert Dark Leven	a theorem Pr
Assumptions Drift velocity Mean collision time Mean free noth &	$z$ theory $\alpha$
expression). Expression for electrical conductivity (no derivation) E	ilures of classical
free-electron theory	futes of classical
Quantum free electron theory: Assumptions Density of states (no.	lerivation) Fermi-
energy, Fermi factor & its temperature dependence Fermi Dirac St.	tistics Expression
for electrical conductivity (derivation) Marite of Overturn free electric	on theory 10hrs
Physics of Semiconductors: Farmi level in intrinsic applicanductors	Expression for the
concentration of electrons in the conduction hand. Hales concentrativ	n in valance hand PO1-3
(only mention the expression). Conduction band, Holes concentration	ration) Hall effect PO2-3
Expression for Hall coefficient (derivation)	PO4-3
Dielectrics: Electric dipole Dipole memory Delegization of dielectric	materials Types of PO6-3
polarization Qualitative treatment of Internal field in calida for one of	imensional infinite PO7-2
array of dipoles (Lorentz field) Clausius Messetti equation (derivat	ion) Numerical PO12-1
problems	PSO1-3
1 O: At the and of this module, the students will be able to	PSO2-2
Los At the end of this module, the students will be able to	1502-2
1. Explain CFET, QFET, Fermi energy and Fermi Dirac statisti	
2. Derive an expression for electrical conductivity of semicondi	ictors and Hall
coefficients.	· Marani
<ol> <li>Explain dielectrics, types of polarization and hence arrive Clinical</li> </ol>	usius-Mossotti
equations.	
Module 5: Material Characterization Techniques and Instrumen	tation CO5
Introduction to materials: Nanomaterials and nanocomposites. Princ	ple, construction and
working of X-ray Diffractometer, crystal size determination by	Scherrer equation, 10hrs
Principle, construction, working and applications of Atomic Force	Microscopy (AFM),
Fourier Transform Infrared Spectroscopy (FTIR), Xray Photoelectron	Spectroscopy (XPS), PO1-3
Scanning Electron Microscopy (SEM), Transmission Electron	Microscopy (TEM), PO2-1
Scanning tunneling electron microscopy (STEM).	PO4-1
LO: At the end of this module, the students will be able to	PO6-3
1. Explain nanomaterials and nanocomposites.	PO7-3
2. Determine crystal size using Scherrer equation.	PO12-1
3 Explain the construction and working of various nanomateria	l characterization PSO1-3
instruments.	PSO2-3
Text Books	
The Doors	P.G. Kshirsagar 10th revised Ed
1. A Text book of Engineering Physics- W.N. Avadianulu and	1.0. Kimisagai, tom tovised Ed,
S.Chand & Company Ltd, New Delni	vadhanulu and P.S. Hemne revised
2. An Introduction to Lasers theory and applications by M.N.A.	vaditatiditu alidi F.S.Hennite Tevised
edition 2012. S. Chand and company Ltd -New Delni.	2017
3. Engineering Physics-Gaur and Gupta-Dhanpat Kai Publicati	OHS-2017
<ol><li>Concepts of Modern Physics-Arthur Beiser: 6th Ed; Tata Mo</li></ol>	Graw filli Edu Pvi Lid- New Delm
2006	
<ol><li>X-ray diffraction- B E Warren published by Courier Corpora</li></ol>	tion.
<ol><li>Nano composite materials-Synthesis, properties and applicat</li></ol>	ions, CRC Press.
Reference Books (specify minimum two foreign authors text boo	(S)
1 Introduction to Mechanics — M.K. Verma: 2nd Ed. Univers	ty Press(India) Pvt Ltd, Hyderabad
1. Infordaction to Meenanies Miller Contain Date any	

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- 2. Lasers and Non Linear Optics B.B. Laud, 3rd Ed, New Age International Publishers 2011
- 3. LASERS Principles, Types and Applications by K.R, Nambiar-New Age International Publishers.
- 4. Solid State Physics-S O Pillai, 8th Ed- New Age International Publishers-2018
- Shock waves made simple- Chintoo S Kumar, K Takayama and KPJ Reddy: Willey India Pvt. Ltd.New Delhi2014
- Materials Characterization Techniques-Sam Zhang, Lin Li, Ashok Kumar, CRC Press, First Edition, 2008
- 7. Characterization of Materials- Mitra P.K . Prentice Hall India Learning Private Limited

### Web links and Video Lectures (e-Resources):

- https://www.britannica.com/technology/laser,k
- https://nptel.ac.in/courses/115/102/115102124/
- http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
- https://onlinecourses.nptel.ac.in/noc20\_mm14/preview
- W1 Nptel.ac.in
- W2 www.physics.org
- W3 www.physicsclassroom.com
- W4 www.coursera.org

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- http://nptel.ac.in
- https://swayam.gov.in
- https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham

### **Useful Journals**

- Journal of Nature Physics
- Journal of Foundation of Physics
- Journal of Physical Review
- Journal of Applied Physics
- Journal of Classical and Quantum Gravity

### **Teaching and Learning Methods**

- 1. Lecture class: 40 hours
- 2. Practical classes: 2 hours

### Assessment

Type of test/examination: Written examination

**Continuous Internal Evaluation(CIE)**: 50 marks (20 marks i.e., Sum of three tests + 20 marks Assignments + 20 marks Assignment activity)

Semester End Exam (SEE): 100 marks (students have to answer all main questions) which will be reduced to 50 Marks.

Test duration: 1:00 hours

Examination duration: 3 hours

<i>co</i>	РО	PO1	PO2	PO3	РО 4	PO5	PO6	РО 7	PO8	PO9	PO10	PO1 1	PO12	P S O	P S O 2
21PHY12	K- leve l													1	2
C01	K3	3	2	-	1		2	2	-		-	-	1	3	1
CO2	K3	3	3	-	3	-	3	1	-	-	-	-	1	3	2
CO3	K3	3	2	-	2	-	2	3	-		-	-	1	3	2
CO4	K3	3	3	-	3	-	3	2	-	-	-	-	1	3	2
CO5	K3	3	1	-	1	-	3	3	-	-	-	-	1	3	3
K3       3       1       -       1       -       3       3       -       1															

**PSO1:** Ability to understand the basic principles, laws, theories and problem solving skins of Engineering Physics and their application in engineering and technology.

PSO2: Ability to apply the concepts of physics to design a process to address the real world challenges.

Course In charge

Head of the Department

Dr. C. VASUDEV Professor & Head Department of Basic Science KSSchool of Engineering and Managemen Bangalore - 560 109.

12 Rome Principal

Dr. K. RAMA NARASIMHA Principal/Director K S School of Engineering and Manageme Bengaluru - 560 109



## K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BENGALURU - 560109 DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

### **CO-PO Mapping**

Course: SYSTEM SIMULATION AND MODELLING											
Type: Elective Course Code: 18CS645											
No of Hours											
(Lec	Theory         Practical/Field Work/Allied         Total/Week         Total teaching hours           (Lecture Class)         Activities         Total/Week         Total teaching hours										
	4		0		4		40				
	Marks										
Internal Assessment Examination Total Credits											
40 60 100 3											
Aim/Objectives of the Course											
<ol> <li>To explain the basic system concept and definitions of system and discuss technique to model and to simulate various systems.</li> <li>To understand and illustrate various techniques to generate random numbers.</li> <li>To interpret input models and estimate their performance.</li> <li>To utilize characteristics of queuing system and use techniques to implement statistical models.</li> <li>To outline the verification and validation of models.</li> </ol>											
Cours	se Learning (	Outo	comes ourse, the students will be a	ble to							
COL	Applying (K3)										
	techniques to simulate various systems.										
CO2	CO2 Utilize the properties of random numbers and generate random variates using (i.e.)										
CO3 Interpret the use of input models in simulation by choosing the statistical Applying (K3)								Applying (K3)			
CO4	Summarize characteristics of queuing system, and apply suitable techniques to App										
C05	Outline the	e ol	itput performance of sir	nulation	data and mak	e use	of the	Applying (K3)			
COS	information	to II	nprove the system perform								
			S	vllabus	Content			001			
			0					COL			
Modu Introd	le 1 luction: Wh	nen	simulation is the app	ropriate	tool and wh lation: Areas o	en it f app	is not lication,	8 hrs			
appro	priate, Adva	intag	ges and disadvantages c	nents c	of a system;	Discr	ete and	POI-3			
Syster	ms and sys	stem	environment; Compo	s of Mo	dels. Discrete-	Event	System	PO2-2			
contin	nous system	ns, N	Aodel of a system; Type	S UI IVIO	General Princi	ples.		PO3-2			
Cimul	ation examn	les:	Simulation of queuing s	ystems.	Ocheral I mer			P05-2			
Simul	auon examp							P09-2			
	t the and of t	hiss	ession the student will be a	able to,	to and not annr	onriate	2.	PO12-1			
LO: A	t the end of t	ums s	tances when simulation is	appropri	ate and not appre	opriad		PSO1-3			
1.		tom	and its components.					10012			
2.	Explain sys	(CIII									

3. Explain different types of simulation models.	PSO
<ol><li>Simulate discrete event systems and analyze the system.</li></ol>	6.1
5. Explain event-scheduling / time-advance algorithm and apply event scheduling	
algorithm to simulate the system.	
<b>Module 3: Random-Number Generation:</b> Properties of random numbers; Generation of pseudo-random numbers, Techniques for generating random numbers, Tests for Random Numbers, Random-Variate Generation: Inverse transform technique, Acceptance- Rejection technique.	CO2
LO: At the end of this session the student will be able to,	8 hrs.
	PO1-3
1. Explain different techniques for random number generation	PO2-2
2. Generate random numbers using various techniques	PO3-2 PO5-2
3. Explain and apply KS test Chi square test inverse transformation	P03-2 P09-2
technique,	PO12 -1
4. Acceptance-rejection technique	PSO1-3
5. Generate random variate using income to a const	PSO2-3
rejection technique.	•
<ul> <li>uata, Parameter estimation, Goodness of Fit Tests, Fitting a non-stationary Poisson process, Selecting input models without data, Multivariate and Time-Series input models. Estimation of Absolute Performance: Types of simulations with respect to output analysis, Stochastic nature of output data, Measures of performance and their estimation.</li> <li>LO: At the end of this session the student will be able to, <ol> <li>Explain the steps involved in development of a good input model</li> <li>Explain multivariate and time-series input models</li> <li>Explain the types of simulation with respect to output analysis</li> </ol> </li> </ul>	8 hrs PO1-3 PO2-2 PO3-2 P05-2 P09-2 PO12 -1 PSO1-3
	PSO2-3
Module 2	PSO2-3
Module 2 Statistical Models in Simulation: Review of terminology and concepts, Useful statistical models, Discrete distributions. Continuous distributions, Poisson process,	PSO2-3 CO4 8 hrs
Module 2 Statistical Models in Simulation: Review of terminology and concepts, Useful statistical models, Discrete distributions. Continuous distributions, Poisson process, Empirical distributions.	PSO2-3 CO4 8 hrs
Module 2 Statistical Models in Simulation: Review of terminology and concepts, Useful statistical models, Discrete distributions. Continuous distributions, Poisson process, Empirical distributions. Queuing Models: Characteristics of queuing systems, Queuing notation, Long-run	PSO2-3 CO4 8 hrs PO1-3
Module 2 Statistical Models in Simulation: Review of terminology and concepts, Useful statistical models, Discrete distributions. Continuous distributions, Poisson process, Empirical distributions. Queuing Models: Characteristics of queuing systems, Queuing notation, Long-run measures of performance of queuing systems, Long-run measures of performance of	PSO2-3 CO4 8 hrs PO1-3 PO2-2 PO2-2
Module 2 Statistical Models in Simulation: Review of terminology and concepts, Useful statistical models, Discrete distributions. Continuous distributions, Poisson process, Empirical distributions. Queuing Models: Characteristics of queuing systems, Queuing notation, Long-run measures of performance of queuing systems, Long-run measures of performance of queuing systems cont,Steady-state behavior of M/G/1 queue, Networks of queues.	PSO2-3 CO4 8 hrs PO1-3 PO2-2 PO3-2 PO5-2
<ul> <li>Module 2</li> <li>Statistical Models in Simulation: Review of terminology and concepts, Useful statistical models, Discrete distributions. Continuous distributions, Poisson process,</li> <li>Empirical distributions.</li> <li>Queuing Models: Characteristics of queuing systems, Queuing notation, Long-run measures of performance of queuing systems, Long-run measures of performance of queuing systems cont,Steady-state behavior of M/G/1 queue, Networks of queues.</li> <li>LO: At the end of this session the student will be able to,</li> </ul>	PSO2-3 CO4 8 hrs PO1-3 PO2-2 PO3-2 PO3-2 PO5-2 P09-2
<ul> <li>Module 2</li> <li>Statistical Models in Simulation: Review of terminology and concepts, Useful statistical models, Discrete distributions. Continuous distributions, Poisson process, Empirical distributions.</li> <li>Queuing Models: Characteristics of queuing systems, Queuing notation, Long-run measures of performance of queuing systems, Long-run measures of performance of queuing systems cont,Steady-state behavior of M/G/1 queue, Networks of queues.</li> <li>LO: At the end of this session the student will be able to,</li> <li>L Explain various statistical models in simulation</li> </ul>	PSO2-3 CO4 8 hrs PO1-3 PO2-2 PO3-2 PO5-2 P09-2 PO12 -1
<ul> <li>Module 2</li> <li>Statistical Models in Simulation: Review of terminology and concepts, Useful statistical models, Discrete distributions. Continuous distributions, Poisson process,</li> <li>Empirical distributions.</li> <li>Queuing Models: Characteristics of queuing systems, Queuing notation, Long-run measures of performance of queuing systems, Long-run measures of performance of queuing systems cont,Steady-state behavior of M/G/1 queue, Networks of queues.</li> <li>LO: At the end of this session the student will be able to,</li> <li>1. Explain various statistical models in simulation</li> <li>2. Solve the problems using statistical models</li> </ul>	PSO2-3 CO4 8 hrs PO1-3 PO2-2 PO3-2 PO3-2 PO5-2 PO9-2 PO12 -1 PSO1-3
<ul> <li>Module 2</li> <li>Statistical Models in Simulation: Review of terminology and concepts, Useful statistical models, Discrete distributions. Continuous distributions, Poisson process, Empirical distributions.</li> <li>Queuing Models: Characteristics of queuing systems, Queuing notation, Long-run measures of performance of queuing systems, Long-run measures of performance of queuing systems cont,Steady-state behavior of M/G/1 queue, Networks of queues.</li> <li>LO: At the end of this session the student will be able to,</li> <li>1. Explain various statistical models in simulation</li> <li>2. Solve the problems using statistical models</li> <li>3. Explain characteristics of queuing systems</li> </ul>	PSO2-3 CO4 8 hrs PO1-3 PO2-2 PO3-2 PO3-2 PO5-2 PO9-2 PO12 -1 PSO1-3 PSO2-3

Module 5: Measures of performance and their estimation, Output analysis for terminating simulations Continued, Output analysis for steady-state simulations.       Output analysis for steady-state simulations.         Verification, Calibration And Validation: Optimization: Model building, verification and validation, Verification of simulation models, Verification of simulation models, Calibration and validation of models, Optimization via Simulation.       8t         LO: At the end of this session the student will be able to,       90         1. Differentiate between terminating simulation and steady state simulation.       90         2. Explain model building, verification and validation of simulation.       90         3. Explain the iterative process of calibrating a model.       90         4. Explain the three steps approach to validation by Naylor and Finger.       90         Text Books       1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event         3. i. Jetime, 5 th Edition, Pearson Education, 2010.       910	05
<ul> <li>Would S: Measures of performance and their estimation, Output analysis for steady-state simulations.</li> <li>Verification, Calibration And Validation: Optimization: Model building, verification and validation, Verification of simulation models, Verification of simulation models, Calibration and validation of models, Optimization via Simulation.</li> <li>LO: At the end of this session the student will be able to,</li> <li>1. Differentiate between terminating simulation and steady state simulation.</li> <li>2. Explain model building, verification and validation of simulation.</li> <li>3. Explain the iterative process of calibrating a model.</li> <li>4. Explain the three steps approach to validation by Naylor and Finger.</li> <li>Text Books</li> <li>1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event</li> <li>7. Sth Edition, Pearson Education, 2010.</li> </ul>	
Verification, Calibration And Validation: Optimization: Model building,         verification and validation, Verification of simulation models, Verification of simulation models, Calibration and validation of models, Optimization via         Simulation.         LO: At the end of this session the student will be able to,         1. Differentiate between terminating simulation and steady state simulation.         2. Explain model building, verification and validation of simulation.         3. Explain the iterative process of calibrating a model.         4. Explain the three steps approach to validation by Naylor and Finger.         1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event         cited to the fittion, Pearson Education, 2010.	hrs
<ul> <li>simulation models, Calibration and validation of models, Optimization</li> <li>Simulation.</li> <li>LO: At the end of this session the student will be able to,</li> <li>1. Differentiate between terminating simulation and steady state simulation.</li> <li>2. Explain model building, verification and validation of simulation.</li> <li>3. Explain the iterative process of calibrating a model.</li> <li>4. Explain the three steps approach to validation by Naylor and Finger.</li> <li>Text Books</li> <li>1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event</li> </ul>	)1-3 )2-2
<ul> <li>LO: At the end of this session the student will be able to,</li> <li>1. Differentiate between terminating simulation and steady state simulation.</li> <li>2. Explain model building, verification and validation of simulation.</li> <li>3. Explain the iterative process of calibrating a model.</li> <li>4. Explain the three steps approach to validation by Naylor and Finger.</li> <li>Text Books</li> <li>1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event</li> <li>3. Simulation S. Carson II, Barry L. Nelson, 2010.</li> </ul>	13-2 15-2
<ol> <li>Explain the iterative process of calibrating a model.</li> <li>Explain the iterative process of calibrating a model.</li> <li>Explain the three steps approach to validation by Naylor and Finger.</li> <li>Explain the three steps approach to validation by Naylor and Finger.</li> <li>Explain the three steps approach to validation by Naylor and Finger.</li> <li>Explain the three steps approach to validation by Naylor and Finger.</li> <li>Explain the three steps approach to validation by Naylor and Finger.</li> <li>Explain the three steps approach to validation by Naylor and Finger.</li> <li>Explain the three steps approach to validation by Naylor and Finger.</li> <li>Explain the three steps approach to validation by Naylor and Finger.</li> <li>Explain the three steps approach to validation by Naylor and Finger.</li> <li>Explain the three steps approach to validation by Naylor and Finger.</li> <li>Explain the three steps approach to validation by Naylor and Finger.</li> <li>Explain the three steps approach to validation by Naylor and Finger.</li> <li>Explain the three steps approach to validation by Naylor and Finger.</li> <li>Explain the three steps approach to validation by Naylor and Finger.</li> <li>Explain the three steps approach to validation by Naylor and Finger.</li> </ol>	9-2 12 -1 01-3 02-3
<b>Text Books</b> 1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event Simulation, 5 th Edition, Pearson Education, 2010.	
1. Jerry Banks, John S. Carson II, Barry 2	
Reference Books (specify minimum two foreign authors text books) Reference Books (specify minimum two foreign authors text books) M. Leemis, Stephen K. Park: Discrete – Event Simulation: A First Course, Pearson Education	on, 2006.
<ol> <li>Lawrence M. Leenins, et al.</li> <li>Averill M. Law: Simulation Modeling and Analysis, 4th Edition, Tata McGraw Time</li> </ol>	
Useful Websites         • <a href="http://www.systems-thinking.org/modsim/modsim.htm">http://www.systems-thinking.org/modsim/modsim.htm</a> • <a href="http://www.systems-thinking.org/modsim/modsim.htm">http://www.systems-thinking.org/modsim/modsim.htm</a> • <a href="http://web.stanford.edu/class/archive/ee/ee392m/ee392m/ee392m.1056/Lecture9_ModelSim.pdf">http://web.stanford.edu/class/archive/ee/ee392m/ee392m/ee392m.1056/Lecture9_ModelSim.pdf</a> • <a href="http://www.eolss.net/sample-chapters/c15/e1-26-05-04.pdf">http://www.eolss.net/sample-chapters/c15/e1-26-05-04.pdf</a> • <a href="https://shamsulsarip.files.wordpress.com/2015/07/system-modelling-and-simulation.pdf">http://www.eolss.net/sample-chapters/c15/e1-26-05-04.pdf</a> • <a href="https://shamsulsarip.files.wordpress.com/2015/07/system-modelling-and-simulation.pdf">https://shamsulsarip.files.wordpress.com/2015/07/system-modelling-and-simulation.pdf</a>	
<ul> <li>Useful Journals</li> <li>A.LisJak, G.Grasselli: " A review of discrete modering discrete</li></ul>	ences,
volume 1, 2013 Teaching and Learning Methods	
1. Lecture class: 40 Hrs	
2. Revision : Ill's	
Assessment f tost/examination: Written examination	
<b>Type of test examination</b> <b>Continuous Internal Evaluation</b> (CIE) : 40 marks (Average of three <b>Continuous Internal Evaluation</b> (CIE) : 40 marks (Average of three <b>Continuous Internal Evaluation</b> (CIE) : 40 marks (Average of three <b>Continuous Internal Evaluation</b> (CIE) : 40 marks (Average of three <b>Continuous Internal Evaluation</b> (CIE) : 40 marks (Average of three <b>Continuous Internal Evaluation</b> (CIE) : 40 marks (Average of three <b>Continuous Internal Evaluation</b> (CIE) : 40 marks (Average of three <b>Continuous Internal Evaluation</b> (CIE) : 40 marks (Average of three <b>Continuous Internal Evaluation</b> (CIE) : 40 marks (Average of three <b>Continuous Internal Evaluation</b> (CIE) : 40 marks (Average of three <b>Continuous Internal Evaluation</b> (CIE) : 40 marks (Average of three <b>Continuous Internal Evaluation</b> (CIE) : 40 marks (Average of three <b>Continuous Internal Evaluation</b> (CIE) : 40 marks (Average of three <b>Continuous Internal Evaluation</b> (CIE) : 40 marks (Average of three <b>Continuous Internal Evaluation</b> (CIE) : 40 marks (Average of three <b>Continuous Internal Evaluation</b> (CIE) : 40 marks (Average of three <b>Continuous Internal Evaluation</b> (CIE) : 40 marks (Average of three <b>Continuous Internal Evaluation</b> (CIE) : 40 marks (Average of three <b>Continuous Internal Evaluation</b> (CIE) : 40 marks (Average of three <b>Continuous Internal Evaluation</b> (CIE) : 40 marks (Average of three <b>Continuous Internal Evaluation</b> (CIE) : 40 marks (Average of three <b>Continuous Internal Evaluation</b> (CIE) : 40 marks (Average of three <b>Continuous Internal Evaluation</b> (CIE) : 40 marks (Average of three <b>Continuous Internal Evaluation</b> (CIE) : 40 marks (Average of three <b>Continuous Internal Evaluation</b> (CIE) : 40 marks (Average of three <b>Continuous</b> (CI	iced to 60
Semester End Exam(022)	
Test duration: 1:30 hrs	
Examination duration: 3 hrs	

CO to PO	Mapping
<ul> <li>PO1: Science and engineering Knowledge</li> <li>PO2: Problem Analysis</li> <li>PO3: Design &amp; Development</li> <li>PO4:Investigations of Complex Problems</li> <li>PO5: Modern Tool Usage</li> </ul>	PO7:Environment and Society PO8:Ethics PO9:Individual & Team Work PO10: Communication PO11:Project Mngmt & Finance PO12:Life long Learning
<b>PO6:</b> Engineer & Society	

**PSO1:** Understand fundamental and advanced concepts in the core areas of Computer Science and  $r_i$ 

Engineering to analyze, design and implement the solutions for the real world problems. PSO2: Utilize modern technological innovations efficiently in various applications to work towards the

betterment of society and solve engineering problems.

D	РО	PO1	PO2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO9	PO10	PO1 1	PO12	PS O1	PS O2
	K-level														
										2	-	-	1	3	3
1	K3	3	2	2	-	2	-	-		2		-	1	3	3
2	K3	3	2	2	-	2	-	-	-	2	-		1	3	3
	17.2	2	2	2	-	2	-	-	-	2.	-	-	1	5	
5	K3	3	2	2		-			-	2	-	-	1	3	ز
1	K3	3	2	2	-	2	-	-		2			1	3	3
5	K2	3	2	2	-	2	-	-	-	2	-				

Course In charge

Head of the Department

/ < . Corro Principal

HOD Dept. of Computer Science & Engineering K S School of Engineering and Management K.S. School of Engineering & Management Bengaluru - 560 109 Bangalore-560 062,

Dr. K. RAMA NARASIMHA Principal/Director Bengaluru - 560 109



C

## K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109

### **DEPARTMENT OF CIVIL ENGINEERING**

#### **CO-PO MAPPING**

Course: Elements of Civil Engineering and Mechanics										
Type: Core Course Code: 21CIV24										
No of Hours										
T (Lect	heory	Pra	Activities	Т	otal/Week	Total	teaching hours			
(1000	31.		Activities	3 40						
Interr	Credits									
50 $50$ $100$ $3$										
Aim/C	Aim/Objectives of the Course									
Cours	<ul> <li>To make students learn the scope of various fields of civil engineering.</li> <li>To develop students' ability to analyze the problems involving forces, moments with their applications.</li> <li>To develop the student's ability to find out the center of gravity and moment of inertia and their applications.</li> <li>To make the students learn about kinematics and kinetics and their applications.</li> </ul>									
After	completing t	he co	ourse, the students will be a	able to						
C01	CO1Understand and explain the various fields of civil engineering and the different building materials used.K3 Applying									
CO2	<b>CO2</b> Determine the resultant and moment for a given force system subjected to various loads and calculate the friction, reactive forces and the effects that develop as a result of the external loads on rigid bodies.									
СОЗ	CO3 Analyze statically determinate beams and trusses (method of joints and sections).									
CO4	Calculate	centr	oid and moment of inertia	of regula	r and built-up sec	ctions.	K3 Applying			
CO5	Obtain the		K3 Applying							
			Sylla	abus Con	tent					
Modu engine	le 1: Ove	rviev echni	v of Civil Engineering cal engineering, Construc	Systems: ction tec	Introduction to nnology, hydrau	structural lics, water	C01			
resour sanita	rces and irri	gatio ng, (	n engineering transportat GIS, earthquake engineer	ion engir ing. Role	eering, environr of civil engine	mental and eers in the	8 hrs			
develo	opment of the	e nat	ion.				PO1-3			
Build	ing material	s:	<b>1</b> . <b>1</b>				PO2-2			
Stone	, brick, wood	l, gla	ss, aluminum, cement, ag	gregates,	concrete, steel, l	RCC, PSC,	PO4-1			
smart	materials.			11.		,	PO12 -1			
	At the end of	this	session the student will be	able to			PSO1-3			
1.	List and ex Explain the	cplai le ro	n the scope of different bra le of a civil engineer in t	inches of the infras	tructural develop	g. pment of a	PSO2-1			
	country.									



3. List and explain the composition, manufacturing processes, properties and	
Uses of various building materials used in construction.	
forces superposition transmissibility Desolution and composition of forces I aw of	
Porellalogram of foreage polygonal law Desultant of consument conlenge foreag	
Parallelogram of forces, polygonal law, Resultant of concurrent coplanar force	
system, coplanar non-concurrent force system, a moment of forces, couple, Varignons	
theorem,	
Resultant of coplanar non-concurrent force system, free body diagram, Lamis	
theorem, equations of equilibrium, equilibrium of concurrent and non-concurrent	
coplanar force system.	
Friction: Types of friction, laws of friction, limiting friction, coefficient of friction	
concept of static and dynamic friction, numerical problems on impending motion on	CO2
horizontal and inclined planes along with connected hodies	0.1
LO: At the end of this session the student will be able to	8 hrs.
1 List and explain the basic idealizations in an sinearing muchanism	DO1 2
2. Define force force-system moment counts and reactive the civer force	PO1-3
systems	PO2-3
3. Explain Newton's laws principle of physical independence superposition	PO4-2 PO12 1
transmissibility of forces, equivalent force - countersystem	PO12-1 PSO1-3
4. State and prove Varianon's principle of moments	PSO2-1
5. Determine magnitude and direction of resultant of concurrent and non-	1502-1
concurrent system of forces.	
6. Explain free body diagram and its importance, resultant, conditions of	
equilibrium and equilibrant.	
7. State and prove Lami's theorem.	
8. Explain types of friction, laws of friction, limiting friction, angle of friction,	
coefficient of friction and angle of repose.	
9. Calculate friction developed between contact surfaces, force required to cause	
and stop impending motion in blocks on inclined planes, rope and pulley	
systems, ladder friction and wedge friction.	
Module 3: Support reactions: Types of loads and types of supports, statically	
determinate and indeterminate beams, support reactions in beams, Numerical	CO3
problems on support reactions for statically determinate beams (point load, udl,	
uniformly varying loads and moments)	8 hrs
Analysis of trusses:	
Types of trusses, analysis of statically determinate trusses using the method of joints	PO1-3
and method of sections	PO2-3
I O. At the and of this appaien the student will be able to	PO4-3
LO: At the end of this session the student will be able to	PO12-1
1. Explain the types of loads, supports and beams.	PSO1-3
2. Determine the reactions developed at supports.	PSO2-1
3. Analyze statically determinate truss by method of joints and method of	
sections.	
Module 4: Centroid: Introduction, methods of determining the centroid, locating the	<u>CO4</u>
centroid of simple figures from first principle, the centroid of composite and built-up	04
sections	8 hrs
Moment of inertia: Introduction method of determining the second moment of area	0 11 5
of plane sections from first principles, notallal avia theorem and norman digular avia	PO1-3
the section model is the section and perpendicular axis	PO2-3
theorem section modulus, the radius of gyration, moment of inertia of composite area	



<ul> <li>LO: At the end of this session the student will be able to <ol> <li>Explain the concepts of centroid and moment of inertia.</li> <li>State and prove Parallel axis theorem and Perpendicular axis theorem.</li> <li>Derive equation for determining centroid of regular geometric shapes.</li> <li>Locate the centroid and determine moment of inertia of regular and given sections.</li> </ol> </li> <li>Module 5: Kinematics: Displacement, average velocity, instantaneous velocity, speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, Newton's law of motion, rectilinear motion and numerical problems, curvilinear motion under gravity, numerical problems Kinetics: D 'Alembert's principle and its application in-plane motion and connected bodies including pulleys.</li> <li>LO: At the end of this session the student will be able to <ol> <li>Define displacement, average velocity, instantaneous velocity, speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, rectilinear motion, curvilinear Motion, super elevation, projectile motion, relative motion, notion, relative motion, acceleration due to gravity, rectilinear motion, curvilinear Motion, super elevation, projectile pol2-3 PO4-3 PO1-3 PO</li></ol></li></ul>						
<ol> <li>Explain the concepts of centroid and moment of inertia.</li> <li>State and prove Parallel axis theorem and Perpendicular axis theorem.</li> <li>Derive equation for determining centroid of regular geometric shapes.</li> <li>Derive equation for determining moment of inertia of regular geometric shapes.</li> <li>Locate the centroid and determine moment of inertia of regular and given sections.</li> <li>Module 5: Kinematics: Displacement, average velocity, instantaneous velocity, speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, Newton's law of motion, rectilinear motion, super elevation, projectile motion, relative motion, numerical problems, motion under gravity, numerical problems Kinetics: D 'Alembert's principle and its application in-plane motion and connected bodies including pulleys.</li> <li>LO: At the end of this session the student will be able to         <ul> <li>Define displacement, average velocity, instantaneous velocity, speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, rectilinear motion, curvilinear Motion, super elevation, projectile motion, relative motion, projectile motion, relative motion, projectile motion, super elevation, projectile motion, relative motion, super elevation, projectile motion, projectile motion, super elevation, projectile motion, projectile motion, relative motion, super elevation, projectile motion, projectile motion, projectile motion, relative motion, projectile motion, super elevation, projectile motion, projectile motion, relative motion, projectile mo</li></ul></li></ol>						
<ul> <li>2. State and prove Parallel axis theorem and Perpendicular axis theorem.</li> <li>3. Derive equation for determining centroid of regular geometric shapes.</li> <li>4. Derive equation for determining moment of inertia of regular geometric shapes.</li> <li>5. Locate the centroid and determine moment of inertia of regular and given sections.</li> <li>Module 5: Kinematics: Displacement, average velocity, instantaneous velocity, speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, Newton's law of motion, rectilinear motion, relative motion, numerical problems, motion under gravity, numerical problems Kinetics: D 'Alembert's principle and its application in-plane motion and connected bodies including pulleys.</li> <li>LO: At the end of this session the student will be able to <ol> <li>Define displacement, average velocity, instantaneous velocity, speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, rectilinear motion, curvilinear Motion, super elevation, projectile motion, relative motion.</li> </ol> </li> </ul>						
<ul> <li>3. Derive equation for determining centroid of regular geometric shapes.</li> <li>4. Derive equation for determining moment of inertia of regular geometric shapes.</li> <li>5. Locate the centroid and determine moment of inertia of regular and given sections.</li> <li>Module 5: Kinematics: Displacement, average velocity, instantaneous velocity, speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, Newton's law of motion, rectilinear motion and numerical problems, curvilinear motion under gravity, numerical problems Kinetics: D 'Alembert's principle and its application in-plane motion and connected bodies including pulleys.</li> <li>LO: At the end of this session the student will be able to <ol> <li>Define displacement, average velocity, instantaneous velocity, speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, rectilinear motion, curvilinear Motion, super elevation, projectile motion, relative motion.</li> </ol> </li> </ul>						
<ul> <li>4. Derive equation for determining moment of inertia of regular geometric shapes.</li> <li>5. Locate the centroid and determine moment of inertia of regular and given sections.</li> <li>5. Locate the centroid and determine moment of inertia of regular and given sections.</li> <li>Module 5: Kinematics: Displacement, average velocity, instantaneous velocity, speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, Newton's law of motion, rectilinear motion and numerical problems, curvilinear motion under gravity, numerical problems Kinetics: D 'Alembert's principle and its application in-plane motion and connected bodies including pulleys.</li> <li>LO: At the end of this session the student will be able to <ol> <li>Define displacement, average velocity, instantaneous velocity, speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, rectilinear motion, curvilinear Motion, super elevation, projectile motion, relative motion.</li> </ol> </li> </ul>						
shapes.         5. Locate the centroid and determine moment of inertia of regular and given sections.         Module 5: Kinematics: Displacement, average velocity, instantaneous velocity, speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, Newton's law of motion, rectilinear motion and numerical problems, curvilinear motion, super elevation, projectile motion, relative motion, numerical problems, motion under gravity, numerical problems Kinetics: D 'Alembert's principle and its application in-plane motion and connected bodies including pulleys.       CO5         1. Define displacement, average velocity, instantaneous velocity, speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, rectilinear motion, curvilinear Motion, super elevation, projectile motion, relative motion.       PO1-3         PO2-3       PO4-3         PO12-1       PS01-3         PS02-1       PS02-1						
<ul> <li>5. Locate the centroid and determine moment of inertia of regular and given sections.</li> <li>Module 5: Kinematics: Displacement, average velocity, instantaneous velocity, speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, Newton's law of motion, rectilinear motion and numerical problems, curvilinear motion, super elevation, projectile motion, relative motion, numerical problems, motion under gravity, numerical problems Kinetics: D 'Alembert's principle and its application in-plane motion and connected bodies including pulleys.</li> <li>LO: At the end of this session the student will be able to <ol> <li>Define displacement, average velocity, instantaneous velocity, speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, rectilinear motion, curvilinear Motion, super elevation, projectile motion, relative motion.</li> </ol> </li> </ul>						
sections.Module 5: Kinematics: Displacement, average velocity, instantaneous velocity, speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, Newton's law of motion, rectilinear motion and numerical problems, curvilinear motion, super elevation, projectile motion, relative motion, numerical problems, motion under gravity, numerical problems Kinetics: D 'Alembert's principle and its application in-plane motion and connected bodies including pulleys. LO: At the end of this session the student will be able to 1. Define displacement, average velocity, instantaneous velocity, speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, rectilinear motion, curvilinear Motion, super elevation, projectile motion, relative motion.PO1-3 PO2-3 PO4-3 PO12-1 PS01-3 PS02-1						
<ul> <li>Module 5: Kinematics: Displacement, average velocity, instantaneous velocity, speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, Newton's law of motion, rectilinear motion and numerical problems, curvilinear motion, super elevation, projectile motion, relative motion, numerical problems, motion under gravity, numerical problems Kinetics: D 'Alembert's principle and its application in-plane motion and connected bodies including pulleys.</li> <li>LO: At the end of this session the student will be able to <ol> <li>Define displacement, average velocity, instantaneous velocity, speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, rectilinear motion, curvilinear Motion, super elevation, projectile psO1-3 PO1-3 PO2-3 PO4-3 PO1-2 PO1-3 PO1-3 PO1-3 PO1-2 PO1-3 P</li></ol></li></ul>						
<ul> <li>speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, Newton's law of motion, rectilinear motion and numerical problems, curvilinear motion, super elevation, projectile motion, relative motion, numerical problems, motion under gravity, numerical problems Kinetics: D 'Alembert's principle and its application in-plane motion and connected bodies including pulleys.</li> <li>LO: At the end of this session the student will be able to <ol> <li>Define displacement, average velocity, instantaneous velocity, speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, rectilinear motion, curvilinear Motion, super elevation, projectile psO1-3</li> </ol> </li> </ul>						
gravity, Newton's law of motion, rectilinear motion and numerical problems, curvilinear motion, super elevation, projectile motion, relative motion, numerical problems, motion under gravity, numerical problems Kinetics: D 'Alembert's principle and its application in-plane motion and connected bodies including pulleys.CO5LO: At the end of this session the student will be able to 1. Define displacement, average velocity, instantaneous velocity, speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, rectilinear motion.PO1-3 PO2-3 PO4-3 PO1-2 PO1-3 PO1-3 PO2-3 PO1-3 PO2-3 PO1-3 PO2-3 PO1-3 PO2-3 PO1-3 PO2-3 PO1-3 PO1-3 PO2-3 PO1-3 PO1-3 PO2-3 PO1-3 PO2-3 PO1-3 PO2-3 PO1-3 PO2-3 PO1-3 PO2-3 PO1-3 PO2-3 PO1-3 PO2-3 PO1-3 PO2-3 PO1-3 PO2-3 PO1-3 PO2-1						
<ul> <li>curvilinear motion, super elevation, projectile motion, relative motion, numerical problems, motion under gravity, numerical problems Kinetics: D 'Alembert's principle and its application in-plane motion and connected bodies including pulleys.</li> <li>LO: At the end of this session the student will be able to         <ol> <li>Define displacement, average velocity, instantaneous velocity, speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, rectilinear motion, curvilinear Motion, super elevation, projectile motion, relative motion.</li> </ol> </li> </ul>						
<ul> <li>problems, motion under gravity, numerical problems Kinetics: D 'Alembert's</li> <li>principle and its application in-plane motion and connected bodies including pulleys.</li> <li>LO: At the end of this session the student will be able to</li> <li>1. Define displacement, average velocity, instantaneous velocity, speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, rectilinear motion, curvilinear Motion, super elevation, projectile motion, relative motion.</li> <li>8 hrs</li> <li>PO1-3</li> <li>PO2-3</li> <li>PO4-3</li> <li>PO12-1</li> <li>PS01-3</li> <li>PS02-1</li> </ul>						
<ul> <li>principle and its application in-plane motion and connected bodies including pulleys.</li> <li>LO: At the end of this session the student will be able to <ol> <li>Define displacement, average velocity, instantaneous velocity, speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, rectilinear motion, curvilinear Motion, super elevation, projectile motion, relative motion.</li> </ol> </li> <li>PO1-3 PO2-3 PO4-3 PO12-1 PS01-3 PO1-3 PO2-3 PO4-3 PO1-3 PO2-3 PO4-3 PO1-3 PO2-3 PO4-3 PO1-3 PO2-3 PO4-3 PO1-3 PO2-1 PO2-1 PO2-1 PO2-2 PO2-3 PO2-3 PO2-3 PO2-3 PO2-1 PO2-3 PO2-3 PO2-3 PO2-3 PO2-3 PO2-3 PO2-3 PO2-3 PO4-3 PO12-1 PS01-3 PS02-1 PO2-3 PO4-3 PO12-1 PS01-3 PS02-1 PS02-1 PS02-1</li></ul>						
<ul> <li>LO: At the end of this session the student will be able to</li> <li>1. Define displacement, average velocity, instantaneous velocity, speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, rectilinear motion, curvilinear Motion, super elevation, projectile motion, relative motion.</li> <li>PO1-3 PO2-3 PO2-3 PO4-3 PO4-3 PO12-1 PS01-3 PO12-1</li> </ul>						
1. Define displacement, average velocity, instantaneous velocity, speed, acceleration, average acceleration, variable acceleration, acceleration due to gravity, rectilinear motion, curvilinear Motion, super elevation, projectilePO2-3 PO4-3 PO12-1 PS01-3 PS02-1						
acceleration, average acceleration, variable acceleration, acceleration due to gravity, rectilinear motion, curvilinear Motion, super elevation, projectile motion, relative motion.						
gravity, rectilinear motion, curvilinear Motion, super elevation, projectile PSO1-3 motion, relative motion. PSO2-1						
motion, relative motion.						
2. Calculate average velocity, instantaneous velocity, speed, acceleration,						
average acceleration, variable acceleration, acceleration due to gravity,						
rectilinear motion, curvilinear motion, super elevation, projectile motion, and						
relative motion.						
3. Explain D'Alemberts principle.						
Text Books						
1. R.K. Bansal, "A Text Book of Engineering Mechanics", Laxmi Publications.						
2. R. C. Hibbler, "Engineering Mechanics: Principles of Statics and Dynamics", Pearson Press.						
Reference Books (specify minimum two foreign authors text books)						
1 Andy and Rudra Pratap. Introduction to Statics and Dynamics, Oxford University Press.						
2. F.P. Beer and E.R. Johnston, Mechanics of Engineers, Statics and Dynamics, McGraw Hill.						
3. Irving H Shames, Engineering Mechanics, Prentice Hall.						
Useful Websites						
1. http://www.scirp.org/Journal/ojce/						
2 http://www.springer.com/engineering/civil+engineering/journal/12205						
Useful Journals						
1. Journal of Engineering Mechanics ( <u>http://ascelibrary.org/journal/jenmdt</u> )						
2. Canadian Journal of Civil Engineering ( <u>http://www.nrcresearchpress.com/journal/cjce</u> )						
Teaching and Learning Methods						
Lecture class: 40 hrs						

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#### Assessment

Type of test/examination: Written examination.

Continuous Internal Evaluation (CIE): 100 marks {60 marks (total of three tests, each of 20 marks) + 20 (two assignments, each of 10 marks) +20 (Quiz/Seminar. Group Discussion)}, which will be reduced to 50 marks.

Semester End Exam (SEE): 100 marks (students have to answer all main questions) which will be reduced to 50 marks.

Test duration: 1 hr

**Examination duration:** 3 hrs

CO to PO Mapping							
<b>PO1:</b> Science and engineering Knowledge	PO7:Environment and Society						
PO2: Problem Analysis	PO8:Ethics						
PO3: Design & Development	PO9:Individual & Team Work						
<b>PO4:</b> Investigations of Complex Problems	PO10: Communication						
PO5: Modern Tool Usage	PO11:Project Mngmt & Finance						
PO6: Engineer & Society							

PSO1: The proficiency in mathematics, physical and management sciences helps to excel in the areas of planning, analysis related to Civil Engineering systems.

PSO2: Identify sustainable materials and technologies, codes of practice in construction industry and transportation Systems.

со	РО	PO 1	PO 2	PO 3	<b>PO</b> 4	РО 5	PO 6	PO 7	<b>PO</b> 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
21CIV	К-			•											
24	level														
C01	K3	3	2	-	1	-	-	-	-	-	-	-	1	3	1
CO2	K3	3	3	-	3	-	-	-	-	-	-	-	1	3	1
CO3	· K4	3	3	-	3	-	-	-	-	-	-	-	1	3	1
<b>CO4</b>	K3	3	3	-	3	-	-	-	-	-	-	-	1	3	1
CO5	K3	3	3	-	3	-	-		-	-	-	-	1	3	1

Amouth & **Course In charge** 

rolle

Principal

Head - Dept Professor & Head Dept. of Civil Engineering K.S. Group of Institutions K.S. School of Engineering & Management Bangalore-560062.

Dr. K. RAMA NARASIMHA **Principal/Director** K S School of Engineering and Management Bengaluru - 560 109





## K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BENGALURU - 560109 DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING SESSION: 2021-2022 (EVEN SEMESTER)

## CO-PO MAPPING

	GITAL C	OMMUNICATION		Code: 18E	C61		
Type: Core			Col	urse Coue. rom			
71		NO	of Hours	5	Total teachin	g hours	
(Lecture C	Theory Practical/Field Work/Affied Total/Week Total/Week						
4	A Q 4 50						
		v	Marks		Cre	dits	
Internal As	Internal Assessment Examination Total 4						
40 60 100							
<ol> <li>Aim/Objectives of the Course</li> <li>To illustrate the use of Hilbert Transform and represent the binary data using Line Codes.</li> <li>To explain and apply Gram-Schmidt Orthogonalization procedure, detection and estimation in optimum receiver and matched filter receiver.</li> <li>To explain and estimate the probability of error of coherent and non-coherent digital modulation.</li> <li>To Illustrate Correlative coding, precoding and concept of equalization</li> </ol>							
<ol><li>To desc</li></ol>	ribe the sp	pread spectrum modulation t	echnique				
Course Lea After compl	rning Ou eting the	itcomes course, the students will be	able to			÷	
CO1 Exp spec	lain and clopes, r tral dens	d solve Hilbert transfo epresent binary data us sities.	orm, pro ing line	e envelopes, codes and es	and complex stimate power	Applying (K3)	
CO2 Exp estin	Explain and apply Gram-Schmidt Orthogonalization procedure, detection and Applying (K3) estimation concept in optimum receiver and matched filter receiver						
CO3 Exp	lain coh nate the	probability of error.	digital	modulation	techniques and	Applying (K3	
CO4 Exp char prin	lain and mel, Con ciple for	solve estimation of pro rrelative coding, DB and non-ideal channels.	bability d MDB,	of error throu , Pre-coding a	igh bandlimited and equalization	Applying (K	
CO5 spre	<b>Discuss</b> Spread spectrum modulation techniques and solve the properties of spread spectrum modulation technique					Applying (K	
		Syl	labus C	ontent			
MODULE	1:Band	pass signal to equivale	nt low	pass: Hilbert	Transform, Pre-	CO1	
nvelopes, (	Complex	envelopes, Canonical repr	resentatio	on of bandpass	signals, Complex	10 hrs	
ow pass r	epresenta	tion of band-pass system	is, Com	plex represent	ation of bandpas	PO1-3	
ignals and systems							
Line code	· Unin	alar Polar Binolar (AM	and N	fanchester cod	a and their name	PO3-1	
nectral den	sities Ou	verview of HDR3 R379 P	1679 (T	Text 1 Def 1 2	e and men powe	PO4-1	
spectral densities. Overview of HDB3, B3ZS, B6ZS. (Text 1, Ref 1, 2)							
O. At the	ana or an	c caccion the chidant will b	10 0 0 0 0 0	<b>^</b>			
LO: At the	ain and c	is session the student will t	envelope	0 and complex as	avalana	PO12	
LO: At the 1. Exp 2. Exp	ain and s	is session the student will to olve Hilbert transform, pre	envelops	and complex er	nvelops.	PO12 PSO1	

<ul> <li>Module 2: Signaling over AWGN channels-Detection and Estimation' Introduction, Geometric representation of signals, Gram-Schmidt Orthogonalization procedure, Iorxersion of the continuous AWGN channel into a vector channel, Optimum receivers using coherent detection: ML Decoding, Correlation receiver, matched filter receiver.</li> <li>Iohrs.</li> <li>Iohrs.</li></ul>		
Geometric       representation of signals, Gram-Schnidt Orthogonalization proceedure, Conversion of the continuous AWGN channel into a vector channel, Optimum receivers, (Text 1)       10 hrs.         LO: At the end of this session the student will be able to       701-3         PO2-2       PO2-2         Orthogonalization procedure.       700-1         2. Derive expressions for Conversion of the continuous AWGN channel into a vector channel.       700-1         3. Explain and apply the concepts of Optimum receivers using coherent detection- ML Decoding, Correlation receiver and matched filter receiver.       PS01-3         Module 3: Digital Modulation Techniques: Digital modulation formats, Phase shift Keying techniques using coherent detection: BPSK, OPSK generation, and detection and error probabilities, M-ary PSK, M-ary QAM. Frequency shift keying techniques using Coherent deterion: BPSK generation (etchniques: Septian different types of Digital modulation formats.       701-3         No coherent orthogonal modulation techniques.       702-2         3. Derive the expressions for error probabilities for different detection: BPSK generation, detection.       702-2         Without derivation) (Text 1).       10 hrs         LO: At the end of this session the student will be able to 1. Explain the working of BPSK, QPSK generation cechniques.       701-3         S. Derive the expressions for error probabilities for different detection techniques.       702-2         S. Derive the expression for Band Limited Channels i: Digital Transmission       702-2 <td>Module 2: Signaling over AWGN channels-Detection and Estimation: Introduction</td> <td>m, CO2</td>	Module 2: Signaling over AWGN channels-Detection and Estimation: Introduction	m, CO2
<ul> <li>Conversion of the continuous AWGN channel into a vector channel, Optimum receivers.</li> <li>Conversion of the continuous AWGN channel into a vector channel.</li> <li>Explain Geometric representation of signals and solve Gram-Schnidt Orthogonalization procedure.</li> <li>Derive expressions for Conversion of the continuous AWGN channel into a vector channel.</li> <li>Explain and apply the concepts of Optimum receivers using coherent detection-ML Decoding. Correlation receiver and matched filter receiver.</li> <li>Module 3: Digital Modulation Techniques: Digital modulation formats, Phase shift Keying techniques using coherent detection. BPSK, OPSK generation, and detection and error probability.</li> <li>Non coherent orthogonal modulation terniques: Digital modulation formats.</li> <li>Explain different types of Digital modulation formats.</li> <li>Explain the working of Frequency shift keying techniques using Coherent detection. BPSK, OPSK generation. and detection and error probability.</li> <li>Lo: At the end of this session the student will be able to</li> <li>Explain different types of Digital modulation formats.</li> <li>Explain the working of Frequency shift keying techniques.</li> <li>Derive the expressions for error probability.</li> <li>Derive the expressions for error probability.</li> <li>Explain the working of Frequency shift keying techniques.</li> <li>Derive the expressions for error probability for FSK modulation techniques.</li> <li>Derive the expression for error probability.</li> <li>Splain dimited channels - Inter Symbol Interference, Eye diagrams, Signal design for Band Imited channel with zero ISI - Nyquist Criterion (statement only), Sinc PO1-3 PSO2-2</li> <li>Explain the working of Theraymbol Interference, Eye diagrams.</li> <li>Explain the sais: Concepts of Equalization for non-ideal channels – ZFE, MMSE, MMSE.</li> <li>Explain the saisic Concepts of Equalization for non-ideal channels – ZFE, MMSE</li></ul>	Geometric representation of signals, Gram-Schmidt Orthogonalization procedure	C, 10 her
<ul> <li>Construction of the continuous AWGN channel into a procession of the continuous AWGN channel into a vector channel.</li> <li>Explain and apply the concepts of Optimum receivers using coherent detection. Brock and apply the concepts of Optimum receivers using coherent detection. Brock and apply the concepts of Optimum receiver.</li> <li>Module 3: Digital Modulation Techniques: Digital modulation formats, Phase shift keying techniques using coherent detection. Brock generation, detection and error probability of the context of the continuous and Receiver.</li> <li>Module 3: Digital modulation techniques: Digital modulation formats, Phase shift Keying techniques using coherent detection. Brock generation, detection and error probability of error (Without derivation) (Text 1).</li> <li>LO: At the end of this session the student will be able to 1. Explain the working of Brokk, OPSK generation techniques.</li> <li>Derive the expressions for error probability for FSK modulation techniques.</li> <li>Derive the expressions for error probability for FSK modulation techniques.</li> <li>Derive the expressions for error probability for FSK modulation techniques.</li> <li>Derive the expressions for error probability for FSK modulation techniques.</li> <li>Derive the expressions for error probability for FSK modulation techniques.</li> <li>Derive the expressions for error probability for FSK modulation techniques.</li> <li>Derive the expressions for error probability for FSK modulation techniques.</li> <li>Derive the expression of Equalization for non-ideal channels – ZFE, MMSE, MMSE.</li> <li>Derive the expression of Sine and Raised pulse shaping.</li> <li>Apply the concepts of Equalization for non-ideal channels – ZFE, MMSE, MMSE.</li> <li>Explain the basic Concepts of Spread Spectrum, Direct Sequence/SS, Pro2-2</li> <li>PO1-3 PO2-2</li> <li>PO3-1 PO4-1</li> <li>PO4-1</li> <li>PO4-1</li> <li>PO4-1</li> <li>PO4-1</li> <li>PO4</li></ul>	Conversion of the continuous AWGN channel into a vector channel, Optimum receive	rs roms.
<ul> <li>and g concerne extension the student will be able to</li> <li>I. Explain Geometric representation of signals and solve Gram-Schmidt Orthogonalization procedure.</li> <li>Derive expressions for Conversion of the continuous AWGN channel into a vector channel.</li> <li>Explain and apply the concepts of Optimum receivers using coherent detection- ML Decoding, Correlation receiver and matched filter receiver.</li> <li>Module 3: Digital Modulation Techniques: Digital modulation formats, Phase shift Keying techniques using coherent detection: BPSK, QPSK generation, and detection and Keying techniques using coherent detection and Keying techniques using Coherent orthogonal modulation techniques: Digital modulation formats, Phase shift Non coherent orthogonal modulation techniques: BFSK, DPSK Symbol representation, Block diagrams treatment of Transmitter and Receiver, Probability of error (Without derivation) (Text 1).</li> <li>LO: At the end of this session the student will be able to</li> <li>Explain the working of BPSK, QPSK generation techniques.</li> <li>Derive the expressions for error probabilities for different detection techniques.</li> <li>Derive the expressions for error probability for FSK modulation techniques.</li> <li>Derive the expressions for error probability for FSK modulation techniques.</li> <li>Derive the expressions for error probability for FSK modulation techniques.</li> <li>Derive the expression for signal Anale twith controlled ISI – Correlative coding, DB and Signal design for Band limited channel with controlled ISI – Correlative coding, DB and Signal design for Band limited channel with controlled ISI – Correlative coding, DB and Signal design for Band Imited channel with beable to</li> <li>LO: At the end of this session the student will be able to</li> <li>Lo: At the end of this session the student will be able to</li> <li>Lo: At the end of this session the student will be able to</li> <li>Lo: At the end of this sessi</li></ul>	using coherent detection: ML Decoding, Correlation receiver, matched filter receive	r, POL3
<ul> <li>(100)</li> <li></li></ul>	(Taxt 1)	P02.2
<ul> <li>L. Explain Geometric representation of signals and solve Gram-Schmidt Orthogonalization procedure.</li> <li>Derive expressions for Conversion of the continuous AWGN channel into a vector channel.</li> <li>Explain and apply the concepts of Optimum receivers using coherent detection- ML Decoding, Correlation receiver and matched filter receiver.</li> <li>Module 3: Digital Modulation Techniques: Digital modulation formats, Phase shift Coherent detection: BFSK, Mary QAM. Frequency shift keying techniques using Coherent detection: BFSK, QPSK generation, and detection and troo probabilities, Mary PSK, Mary QAM. Frequency shift keying techniques using Coherent orthogonal modulation techniques: BFSK, DPSK Symbol POI-3</li> <li>POI-4</li> <li>POI-4</li> <li>POI-5</li> <li>POI-6</li> <li>POI-7</li> <li>POI-7</li> <li>POI-7</li> <li>POI-7</li> <li>POI-7</li> <li>POI-7</li> <li>POI-8</li> <li>POI-7</li> <li>POI-7</li> <li>POI-7</li> <li>POI-7</li> <li>POI-8</li> <li>POI-7</li> <li>POI-8</li> <li>POI-7</li> <li>POI-9</li> <li>POI-1</li> <li>POI-1</li> <li>POI-1</li> <li>POI-2</li> <li>POI-2</li> <li>POI-2</li> <li>POI-2</li> <li>POI-2</li> <li>POI-2</li> <li>POI-2</li> <li>POI-3</li> <li>POI-2</li> <li>POI-2</li> <li>POI-1</li> <li>POI-2</li> <li>POI-3</li> <li>POI-3</li> <li>POI-2</li> <li>POI-4</li> <li>POI-4</li> <li>POI-4</li> <li>POI-4</li> <li>POI-5</li> <li>POI-6</li> <li>POI-7</li> <li>POI-7</li> <li>POI-7</li> <li>POI-7</li> <li>POI-8</li></ul>	I O: At the end of this session the student will be able to ZOTTA DIZ JICICOLJ	P02-1
<ul> <li>Explain Octonicular expressions for Conversion of the continuous AWGN channel into a vector channel.</li> <li>Derive expressions for Conversion of the continuous AWGN channel into a vector channel.</li> <li>Explain and apply the concepts of Optimum receivers using coherent detection-ML Decoding, Correlation receiver and matched filter receiver.</li> <li>Module 3: Digital Modulation Techniques: Digital modulation formats, Phase shift Keying techniques using coherent detection: BFSK, OPSK generation, and detection and error probability.</li> <li>Coherent orthogonal modulation techniques: BFSK, DPSK Symbol representation, Block diagrams treatment of Transmitter and Receiver, Probability of error (Without derivation) (Text 1).</li> <li>LO: At the end of this session the student will be able to 1. Explain the working of Frequency shift keying techniques.</li> <li>Explain the working of BPSK, QPSK generation techniques.</li> <li>Derive the expressions for error probability for FSK modulation techniques.</li> <li>Explain the working of Frequency shift keying techniques using Coherent detection: BFSK generation, detection.</li> <li>Derive the expressions for error probability for FSK modulation techniques.</li> <li>Derive the expression for error probability for FSK modulation techniques.</li> <li>Derive the expression for error probability for FSK modulation techniques.</li> <li>Derive the expression for since and Raised pulse shaping.</li> <li>Derive the expression for Since and Raised pulse shaping.</li> <li>Apply the concepts of Equalization for non-ideal channels – ZFE, MMSE, MMSE.</li> <li>Derive the expression for Since and Raised pulse shaping.</li> <li>Derive the expression for Since and Raised pulse shaping.</li> <li>Derive the expression for Since and Raised pulse shaping.</li> <li>Derive the expression for Since and Raised pulse shaping.</li> <li>Derive the expression for Since and Raised pulse shaping.</li> <li>Der</li></ul>	LO. At the end of this desired representation of signals and solve Gram-Schmid	PO4-1
2. Derive expressions for Conversion of the continuous AWGN channel into a vector channel.       PO122         3. Explain and apply the concepts of Optimum receivers using coherent detection. ML Decoding, Correlation receiver and matched filter receiver.       PSO1-3         Module 3: Digital Modulation Techniques: Digital modulation formats. Phase shift Resying techniques using coherent detection. BPSK, OPSK generation, and detection and tercer probabilities. M-ary PSK, M-ary QAM. Frequency shift Resying techniques using Coherent detection: BPSK generation, detection and tercer probability of error probability of error probability of error function (Mitout derivation) (Text 1).       CO3         10. At the end of this session the student will be able to 1. Explain the working of BPSK, QPSK generation techniques.       PO1-2         2. Explain the working of Frequency shift keying techniques using Coherent detection. BFSK generation, detection. BFSK generation, detection techniques.       PO1-2         3. Derive the expressions for error probability for FSK modulation techniques.       PO1-2         4. Explain the working of Frequency shift keying techniques using Coherent ofly. Sinc for Band limited channel with zero ISI - Nyquist Criterion (statement only), Sinc for Band limited channel with zero ISI - Nyquist Criterion (statement only), Sinc for Band limited channel with controlled ISI - Correlative coding, DB and PO1-3         Module 4: Communication through Band Limited Channels: Digital Transmission       PO1-2         Module 4: Communication through Band Limited Channels - ZFE, MMSE, Decoling.       PO1-3         5. Explain the concept of DB and MDB, Pre-coding.	1. Explain Geometric representation	PO5-2
<ul> <li>Derive Expression for Contention receivers using coherent detection-ML Decoding, Correlation receiver and matched filter receiver.</li> <li>Sexplain and apply the concepts of Optimum receivers using coherent detection-ML Decoding, Correlation receiver and matched filter receiver.</li> <li>Module 3: Digital Modulation Techniques: Digital modulation formats, Phase shift Keying techniques using coherent detection: BPSK, QPSK generation, and detection and concepts of Point Point Coherent orthogonal modulation techniques: BFSK, DPSK Symbol Non coherent orthogonal modulation formats.</li> <li>Explain different types of Digital modulation formats.</li> <li>Explain the working of BPSK, QPSK generation techniques.</li> <li>Derive the expressions for error probabilities for different detection after expressions for error probability for FSK modulation techniques.</li> <li>Derive the expressions for error probability for FSK modulation techniques.</li> <li>Derive the expressions for error probability for FSK modulation techniques.</li> <li>Derive the expressions for error probability for FSK modulation techniques.</li> <li>Derive the expression for since and Raised pulse shaping.</li> <li>Derive the expression for Since and Raised pulse shaping.</li> <li>Derive the expression for Since and Raised pulse shaping.</li> <li>Derive the expression for Since and Raised pulse shaping.</li> <li>Derive the expression for Since and Raised pulse shaping.</li> <li>Derive the expression for Since and Raised pulse shaping.</li> <li>Derive the expression for Since and Raised pulse shaping.</li> <li>Derive the expression for Since and Raised pulse shaping.</li> <li>Derive the expression for Since and Raised pulse shaping.</li> <li>Explain the Basic Concepts of Equ</li></ul>	Draine average for Conversion of the continuous AWGN channel into a	PO12-2
3. Explain and apply the concepts of Optimum receivers using coherent detection- ML Decoding, Correlation receiver and matched filter receiver.       PSOI-3 PSO2-2         Module 3: Digital Modulation Techniques: Digital modulation formats, Phase shift Keying techniques using coherent detection: BPSK, OPSK generation, and detection and error probabilities, M-ary PSK, M-ary QAM. Frequency shift keying techniques using Coherent detection: BPSK generation, detection and error probability.       CO3         Non coherent orthogonal modulation techniques: Prepresentation, Block diagrams treatment of Transmitter and Receiver, Probability of error (Without derivation) (Text 1).       POI-3 PO2-2         LO: At the end of this session the student will be able to 1. Explain the working of BPSK, QPSK generation techniques.       POI-3 PO2-2         3. Derive the expressions for error probability for FSK modulation techniques.       PSOI-3 PSO2-2         5. Derive the expressions for error probability for FSK modulation techniques.       PSOI-3 PSO2-2         Module 4: Communication through Band Limited Channels: Digital Transmission through Band limited channel with controlled ISI – Correlative coding, DB and Signal design for Band limited channel with controlled ISI – Correlative coding, DB and Signal design for Band limited channel with barbor physhol Interference, Eye diagrams.       PO1-3 PO2-2 PO3-1 PO1-3         1. Explain the concept of Inter Symbol Interference, Eye diagrams.       PO1-3 PO2-2 PO3-1         2. Derive the expression for Sine and Raised pulse shaping.       PO1-3 PO2-2 PO3-1         3. Apply the concepts of Equalization for non-ideal channels – ZFE, MMSE.	2. Derive expressions for contracting	,
3.       Explain and appy precision receiver and matched filter receiver.       PS02-2         Module 3:       Digital Modulation receiver and matched filter receiver.       PS02-2         Module 3:       Digital Modulation Techniques:       Digital modulation formats, Phase shift       CO3         Keying techniques using coherent detection:       BFSK, OPSK generation, and detection and error probability:       CO3         Coherent orthogonal modulation techniques:       BFSK, DPSK Symbol       PO1-3         Non coherent orthogonal modulation formats.       PS02-2       PO3-1         (Without derivation) (Text 1).       Explain different types of Digital modulation formats.       PO1-3         1.       Explain the working of Frequency shift keying techniques.       PO1-2         2.       Explain the working of Frequency shift keying techniques using Coherent detection: BFSK generation, detection.       PS02-2         3.       Derive the expressions for error probability for FSK modulation techniques.       PS01-3         5.       Derive the expressions for error probability for FSK modulation techniques.       PS01-3         5.       Derive the expressions for error probability for FSK modulation techniques.       PS01-3         6       Bad limited channels - Inter Symbol Interference, Eye diagrams, Signal design       PO1-3         MDB, Pre-coding.       Basic Concepts of Equalization for non-ideal c	2 Evaluin and apply the concepts of Optimum receivers using coherent detection-	PSO1-3
Module 3:       Digital Modulation Techniques: Digital modulation formats, Phase shift       CO3         Keying techniques using coherent detection: BPSK, QPSK generation, and detection and error probabilities, M-ary PSK, M-ary QAM. Frequency shift keying technique using Coherent detection: BPSK generation, detection and error probability.       10 hrs         Non coherent orthogonal modulation techniques: BPSK, DPSK Symbol representation, Block diagrams treatment of Transmitter and Receiver, Probability of error (Without derivation) (Text 1).       10.       10 hrs         LO: At the end of this session the student will be able to       901-3       902-2         2. Explain the working of BPSK, QPSK generation techniques.       905-2       905-2         3. Derive the expressions for error probability for FSK modulation techniques.       901-3       902-2         5. Derive the expressions for error probability for FSK modulation techniques.       9501-3       9502-2         5. Derive the expressions for error probability for FSK modulation techniques.       9501-3       902-2         6. Band limited channels - Inter Symbol Interference, Eye diagrams, Signal design for Band limited channel with zero ISI – Nyquist Criterion (statement only), Sine Gangan design for Sine and Raised pulse shaping.       901-3       902-2         9. Derive the expression for Sine and Raised pulse shaping.       901-3       903-1         9. Derive the expression for Sine and Raised pulse shaping.       901-3       903-1         9. Derive t	5. Explain and apply the conversion receiver and matched filter receiver.	PSO2-2
Module 3:         Digital Modulation Techniques:         Digital modulation tormany of the construction and detection and the construction of the construction.         CO3           Keying techniques using coherent detection:         BPSK, QPSK generation, and detection and error probability.         10 hrs           Coherent detection:         BFSK generation, detection and error probability.         10 hrs           Non coherent orthogonal modulation techniques:         BFSK, QPSK Symbol         POI-3           (Without derivation) (Text 1).         10 hrs         PO4-1         PO4-1           LO: At the end of this session the student will be able to         10 hrs         PO4-1           2. Explain the working of BPSK, QPSK generation techniques.         PO1-3         PO4-1           3. Derive the expressions for error probability for FSK modulation techniques.         PO1-3         PO3-1           5. Derive the expressions for error probability for FSK modulation techniques.         Signal design for Band limited channels - Inter Symbol Interference, Eye diagrams.         PO1-3           10 hrs         PO2-2         PO3-1         PO4-1           10 hrs         PO3-1         PO4-1         PO3-1           11 for band limited channels - Inter Symbol Interference, Eye diagrams.         Signal design for Band limited channel with controlled ISI - Correlative coding. DB and Signal design for Band limited channel will be able to         PO3-1      <	NE Decounty, contraining the state of the st	
Keying techniques using coherent detection: BFSK, OPSK gentation, mean detection: BFSK generation, detection and error probability.       10 hrs         Non coherent orthogonal modulation techniques: BFSK, DPSK Symbol       PO1-3         Non coherent orthogonal modulation techniques: BFSK, DPSK Symbol       PO1-3         representation, Block diagrams treatment of Transmitter and Receiver, Probability of error       PO1-3         (Without derivation) (Text 1).       PO2-2         LO: At the end of this session the student will be able to       PO3-1         2. Explain the working of BPSK, QPSK generation techniques.       PO1-2         3. Derive the expressions for error probability for FSK modulation techniques.       PO1-3         5. Derive the expressions for error probability for FSK modulation techniques.       PS01-3         5. Derive the expressions for error probability for FSK modulation techniques.       PS01-3         Signal design for Band limited channels - Inter Symbol Interference, Eye diagrams.       PO1-3         Signal design for Band limited channel with controlled ISI – Correlative coding, DB and       PO1-3         MDB, Pre-coding. Basic Concepts of Equalization for non-ideal channels – ZFE, MMSE,       PO1-2         PO1-1       PO2-2       PO3-1         PO2-2       PO3-1       PO2-2         PO3-1       PO2-2       PO3-1         Signal design for Band limited channel with controlled I	Module 3: Digital Modulation Techniques: Digital modulation formats, state	CO3
error probabilities, M-ary PSK, M-ary QAM. Frequency and error probability.       10 ms         Coherent detection: BFSK generation, detection and error probability.       POI-3         Non coherent orthogonal modulation techniques:       BFSK, DPSK Symbol         Nor coherent orthogonal modulation techniques:       BFSK, DPSK Symbol         (Without derivation) (Text 1).       LO: At the end of this session the student will be able to       POI-3         1. Explain different types of Digital modulation formats.       POI-2         2. Explain the working of BPSK, QPSK generation techniques.       POI-2         3. Derive the expressions for error probability for FSK modulation techniques.       POI-3         5. Derive the expressions for error probability for FSK modulation techniques.       POI-3         5. Derive the expressions for error probability for FSK modulation techniques.       POI-3         6 rough and limited channels - Inter Symbol Interference, Eye diagrams, Signal design       POI-3         10 hrs       POI-3         9 rough and limited channel with controlled ISI – Correlative coding, DB and       POI-3         9 rough and limited channel with controlled ISI – Correlative coding, DB and       POI-3         9 rough and limited channel with eart Symbol Interference, Eye diagrams.       POI-1         9 rough and limited channel with eart Symbol Interference, Eye diagrams.       POI-2         9 rough and this s	Keying techniques using coherent detection: BPSK, QPSK generation, techniques using	10 hm
Coherent detection: BFSK generation, detection and ording ues:       BFSK, DPSK Symbol       POI-3         Non coherent orthogonal modulation techniques:       BFSK, DPSK Symbol       PO2-2         Non coherent orthogonal modulation techniques:       PO3-1         Without derivation) (Text 1).       Explain different types of Digital modulation formats.       PO3-1         2. Explain the working of BPSK, QPSK generation techniques.       PO6-2         3. Derive the expressions for error probabilities for different detection techniques.       PO3-1         4. Explain the working of Frequency shift keying techniques using Coherent detection: BFSK generation, detection.       PSS0-2         5. Derive the expressions for error probability for FSK modulation techniques.       PO1-3         6. Module 4: Communication through Band Limited Channels: Digital Transmission       PO1-3         10 hrss       PO3-1         11 for Band limited channel with controlled ISI – Correlative coding, DB and       PO1-3         12 mithe expression for Equalization for non-ideal channels – ZFE, MMSE,       PO3-1         10 hrss       PO3-2         11 Explain the concepts of DB and MDB, Pre-coding.       PO1-3         12 Derive the expression for Equalization for non-ideal channels – ZFE, MMSE,       PO3-2         12 Derive the expression for Sinc and Raised pulse shaping.       PO1-3         13 Apply the concepts of DB and MDB, P	error probabilities, M-ary PSK, M-ary QAM. Frequency similar and error probability.	10 ms
Non         coherent         orthogonal         modulation         possibility of error         po2-2           representation, Block diagrams treatment of Transmitter and Receiver, Probability of error         po3-1         po4-1         po4-1           LO: At the end of this session the student will be able to         po4-1         po4-1         po4-1           2. Explain different types of Digital modulation formats.         po6-2         po6-2         po6-2           3. Derive the expressions for error probabilities for different detection techniques.         po1-3         pS02-2           4. Explain the working of Frequency shift keying techniques using Coherent detection: BFSK generation, detection.         pS01-3         pS02-2           5. Derive the expressions for error probability for FSK modulation techniques.         pS01-3         pS02-2           for Band limited channels - Inter Symbol Interference, Eye diagrams, Signal design for Band limited channel with zero ISI – Nyquist Criterion (statement only), Sinc and Raised pulse shaping.         p01-3         pO2-2           10 hrs         pO5-2         pO3-1         pO4-1         pO5-2           10 key ecoding. Basic Concepts of Equalization for non-ideal channels – ZFE, MMSE, MMSE, MMSE.         p01-3         pO2-2           11 Explain the concept of Inter Symbol Interference, Eye diagrams.         p01-3         pO5-2         p01-2           12 Without derivations), Adapt	Coherent detection: BFSK generation, detection and entry persons BFSK, DPSK Symbol	PO1-3
representation, Block diagrams treatment of Transmission       P03-1         (Without derivation) (Text 1).       P04-1         LO: At the end of this session the student will be able to       P05-2         1. Explain different types of Digital modulation formats.       P06-2         2. Explain the working of BPSK, QPSK generation techniques.       P01-2         3. Derive the expressions for error probabilities for different detection techniques.       P03-1         4. Explain the working of Frequency shift keying techniques using Coherent detection: BFSK generation, detection.       PS01-3         5. Derive the expressions for error probability for FSK modulation techniques.       PS01-3         6. Module 4: Communication through Band Limited Channels: Digital Transmission through Band limited channels - Inter Symbol Interference, Eye diagrams, Signal design for Band limited channel with controlled ISI – Correlative coding, DB and Signal design for Band limited channel with controlled ISI – Correlative coding, DB and Signal design for Band limited channel with eable to       P01-3         10. Kat the end of this session the student will be able to       P05-2         11. Explain the concept of Inter Symbol Interference, Eye diagrams.       P01-3         12. Orive the expression for Sinc and Raised pulse shaping.       P01-2         13. Apply the concepts of DB and MDB, Pre-coding.       P01-3         14. Explain the Basic Concepts of Equalization for non-ideal channels – ZFE, MMSE, MMSE.       P01-3	Non coherent orthogonal modulation and Receiver, Probability of error	PO2-2
(Without derivation) (Text 1).       PO4-1         LO: At the end of this session the student will be able to       PO4-1         1. Explain different types of Digital modulation formats.       PO6-2         2. Explain the working of BPSK, QPSK generation techniques.       PO6-2         3. Derive the expressions for error probabilities for different detection techniques.       PS01-3         5. Derive the expressions for error probability for FSK modulation techniques.       PS01-3         5. Derive the expressions for error probability for FSK modulation techniques.       PS01-3         Module 4: Communication through Band Limited Channels: Digital Transmission       Nof         Module 4: Communication through Band Limited Channels: Digital Transmission       PO1-3         Module 4: Communication through Band Limited Channels: Digital Transmission       PO1-3         Mobule 4: Communication through Band Limited Channels: Digital Transmission       PO1-3         Mobule 4: Communication through Band Limited Channels: Digital Transmission       PO1-3         Mobule 4: Communication through Band Limited Channels: Digital Criterion (statement only), Sine       PO1-3         NDB, Pre-coding. Basic Concepts of Equalization for non-ideal channels – ZFE, MMSE,       PO1-2         PO1-2       PO5-2       PO1-2         Notic terive the expression for Sine and Raised pulse shaping.       PO5-2         PO1-3       PO5-2	representation, Block diagrams treatment of Transmitter	PO3-1
<ul> <li>LO: At the end of this session the student will be external the end of this session the student will be expressions for error probabilities for different detection techniques.</li> <li>Explain the working of BPSK, QPSK generation techniques using Coherent detection: BFSK generation, detection.</li> <li>Derive the expressions for error probability for FSK modulation techniques.</li> <li>Derive the expressions for error probability for FSK modulation techniques.</li> <li>Derive the expressions for error probability for FSK modulation techniques.</li> <li>Derive the expressions for error probability for FSK modulation techniques.</li> <li>Derive the expressions for error probability for FSK modulation techniques.</li> <li>Derive the expressions for error probability for FSK modulation techniques.</li> <li>Derive the expressions for error probability for FSK modulation techniques.</li> <li>Module 4: Communication through Band Limited Channels: Digital Transmission through Band limited channel with zero ISI – Nyquist Criterion (statement only), Sine for Band limited channel with controlled ISI – Correlative coding, DB and Signal design for Band limited channel with beable to</li> <li>Adaptive Equalizers (Block diagram only) (Text 2, Ref 2).</li> <li>LO: At the end of this session the student will be able to</li> <li>Explain the concepts of Inter Symbol Interference, Eye diagrams.</li> <li>Derive the expression for Sine and Raised pulse shaping.</li> <li>Apply the concepts of Equalization for non-ideal channels – ZFE, MMSE, MMSE.</li> <li>Explain with a neat block diagram the working of Adaptive Equalizers.</li> <li>Explain with a neat block diagram the working of Adaptive Equalizers.</li> <li>Explain with a neat block diagram the working of Adaptive Equalizers.</li> <li>Explain with a neat block diagram the working of Adaptive Equalizers.</li> <li>Frequency Hopped S, Processing Gain, Interference, and probability of error statem</li></ul>	(Without derivation) (Text 1).	PO4-1
1. Explain different types of Digital modulation tormase.       PO022         2. Explain the working of BPSK, QPSK generation techniques.       PO132         3. Derive the expressions for error probabilities for different detection techniques.       PS01-3         4. Explain the working of Frequency shift keying techniques using Coherent detection: BFSK generation, detection.       PS01-3         5. Derive the expressions for error probability for FSK modulation techniques.       PS01-3         6. Module 4: Communication through Band Limited Channels: Digital Transmission through Band limited channels - Inter Symbol Interference, Eye diagrams, Signal design for Band limited channel with controlled ISI – Correlative coding, DB and Signal design for Band limited channel with controlled ISI – Correlative coding, DB and Signal design for Band limited channel with controlled ISI – Correlative coding, DB and PO1-3       PO1-3         10. Po4-1       PO4-1       PO4-1         11. Explain the concept of Inter Symbol Interference, Eye diagrams.       PO1-2         12. Derive the expression for Sinc and Raised pulse shaping.       PO1-3         13. Apply the concepts of Equalization for non-ideal channels – ZFE, MMSE, MMSE.       PO1-3         14. Explain the concept of Inter Symbol Interference, Eye diagrams.       PO1-3         15. Derive the expression for Sinc and Raised pulse shaping.       PO1-3         16. Explain the Basic Concepts of Equalization for non-ideal channels – ZFE, MMSE, MMSE.       PS01-3         15. Explain with a	LO: At the end of this session the student will be determined	PO5-2
<ul> <li>2. Explain the working of BPSK, QPSK generation (consequence)</li> <li>3. Derive the expressions for error probabilities for different detection techniques.</li> <li>3. Derive the expressions for error probabilities for different detection techniques.</li> <li>5. Derive the expressions for error probability for FSK modulation techniques.</li> <li>5. Derive the expressions for error probability for FSK modulation techniques.</li> <li>5. Derive the expressions for error probability for FSK modulation techniques.</li> <li>5. Derive the expressions for error probability for FSK modulation techniques.</li> <li>5. Derive the expressions for error probability for FSK modulation techniques.</li> <li>6. Derive the expressions for error probability for FSK modulation techniques.</li> <li>7. Derive the expressions for error probability for FSK modulation techniques.</li> <li>7. Derive the expression for error probability for FSK modulation techniques.</li> <li>8. Derive the expression for Equalization for non-ideal channels – ZFE, MMSE,</li> <li>9. MDB, Pre-coding. Basic Concepts of Equalizers (Block diagram only) (Text 2, Ref 2).</li> <li>9. LO: At the end of this session the student will be able to</li> <li>9. Derive the expression for Sinc and Raised pulse shaping.</li> <li>9. Derive the expression for Sinc and Raised pulse shaping.</li> <li>9. Derive the expression for Sinc and Raised pulse shaping.</li> <li>9. Derive the expression for Sinc and Raised pulse shaping.</li> <li>9. Explain the Basic Concepts of Equalization for non-ideal channels – ZFE, MMSE, MMSE, MMSE.</li> <li>9. Explain with a neat block diagram the working of Adaptive Equalizers.</li> <li>9. Explain the Basic Concepts of Equalization for non-ideal channels – ZFE, MMSE.</li> <li>9. Explain with a neat block diagram the working of Adaptive Equalizers.</li> <li>9. Explain with a neat block diagram the working of Adaptive Equalizers.</li> <li>9. Expl</li></ul>	1. Explain different types of Digital modulation formation	PO12-2
<ul> <li>2. Explain the expressions for error probabilities for difference of the expression of th</li></ul>	<ol> <li>Explain the working of BPSK, QPSK generation techniques.</li> </ol>	10.2
3. Derive the working of Frequency shift keying technique expression       PSO2-2         4. Explain the working of Frequency shift keying technique expression       PSO2-2         5. Derive the expressions for error probability for FSK modulation techniques.       PSO2-2         5. Derive the expressions for error probability for FSK modulation techniques.       PSO2-2         6. Module 4: Communication through Band Limited Channels: Digital Transmission       Intervention through Band Limited Channels: Digital Transmission         10 hrs       For Band limited channels - Inter Symbol Interference, Eye diagrams, Signal design       CO4         10 hrs       Signal design for Band limited channel with controlled ISI – Correlative coding, DB and       PO1-3         Signal design for Band limited channel with controlled ISI – Correlative coding, DB and       PO2-2         (without derivations), Adaptive Equalizers (Block diagram only) (Text 2, Ref 2).       PO3-1         (without derivations), Adaptive Equalizers (Block diagram only) (Text 2, Ref 2).       PO4-1         (). Explain the concept of Inter Symbol Interference, Eye diagrams.       PSO2-2         (). Explain the Basic Concepts of Equalization for non-ideal channels – ZFE, MMSE.       PSO1-3         (). Explain with a neat block diagram the working of Adaptive Equalizers.       PSO1-3         (). Explain with a neat block diagram the working of Adaptive Equalizers.       I0 hrs         (). Protectis of Spread Spectrum: Concep	2. Derive the expressions for error probabilities for different derives using Coherent	PSO1-3
4. Explain the BFSK generation, detection.         5. Derive the expressions for error probability for FSK modulation techniques.         5. Derive the expressions for error probability for FSK modulation techniques.         Module 4: Communication through Band Limited Channels: Digital Transmission         through Band limited channels - Inter Symbol Interference, Eye diagrams, Signal design         for Band limited ideal channel with zero ISI – Nyquist Criterion (statement only), Sinc         and Raised pulse shaping.         Signal design for Band limited channel with controlled ISI – Correlative coding, DB and         MDB, Pre-coding. Basic Concepts of Equalization for non-ideal channels – ZFE, MMSE,         (without derivations), Adaptive Equalizers (Block diagram only) (Text 2, Ref 2).         (Without derivations), Adaptive Equalizers (Block diagram only) (Text 2, Ref 2).         (D: At the end of this session the student will be able to         (D: At the end of this session for Sine and Raised pulse shaping.         (D) Apply the concepts of DB and MDB, Pre-coding.         (D) Apply the concepts of Equalization for non-ideal channels – ZFE, MMSE,         (D) Explain with a neat block diagram the working of Adaptive Equalizers.         (D) Explain with a neat block diagram the working of Adaptive Equalizers.         (D) PN sequences for Spread Spectrum: Concept of Spread Spectrum, Direct Sequence/SS,         (Principles of Spread Spectrum – M- sequences with Properties; Gold, Kasami only. PN sequences for Spread S	4 Explain the working of Frequency shift keying teening	PSO2-2
5. Derive the expressions for error probability 101 (101 cmanels: Digital Transmission       CO4         Module 4: Communication through Band Limited Channels: Digital Transmission       10 hrs         for Band limited channels - Inter Symbol Interference, Eye diagrams, Signal design       PO1-3         for Band limited ideal channel with zero ISI – Nyquist Criterion (statement only), Sine       PO1-3         and Raised pulse shaping.       Signal design for Band limited channel with controlled ISI – Correlative coding, DB and         Signal design for Band limited channel with controlled ISI – Correlative coding, DB and       PO1-3         MDB, Pre-coding. Basic Concepts of Equalization for non-ideal channels – ZFE, MMSE,       PO3-1         (without derivations), Adaptive Equalizers (Block diagram only) (Text 2, Ref 2).       PO1-2         LO: At the end of this session the student will be able to       PO1-2         2. Derive the expression for Sine and Raised pulse shaping.       PS01-3         3. Apply the concepts of DB and MDB, Pre-coding.       PS01-3         4. Explain the Basic Concepts of Equalization for non-ideal channels – ZFE,       PS02-2         MMSE.       S. Explain with a neat block diagram the working of Adaptive Equalizers.       PS01-3         5. Explain with a neat block diagram the working of Adaptive Equalizers.       I0 hrs         Frequency Hopped SS, Processing Gain, Interference, and probability of error statement       P01-3	4. Explain and BFSK generation, detection.	
Discrete       Order       CO4         Module 4:       Communication through Band Enfined concepts, Eye diagrams, Signal design through Band limited channels - Inter Symbol Interference, Eye diagrams, Signal design for Band limited ideal channel with zero ISI – Nyquist Criterion (statement only), Sinc and Raised pulse shaping.       CO4         Signal design for Band limited channel with controlled ISI – Correlative coding, DB and Signal design for Band limited channel with controlled ISI – Correlative coding, DB and Signal design for Band limited channel with controlled ISI – Correlative coding, DB and Signal design for Band limited channel will be able to 1. Explain the concept of Inter Symbol Interference, Eye diagrams.       PO1-3 PO2-2 PO3-1 PO4-1         2. Derive the expression for Sine and Raised pulse shaping.       PSO1-3 PSO2-2         3. Apply the concepts of DB and MDB, Pre-coding.       PSO1-3 PSO2-2         4. Explain the Basic Concepts of Equalization for non-ideal channels – ZFE, MMSE.       PSO1-3 PSO2-2         5. Explain with a neat block diagram the working of Adaptive Equalizers.       PSO1-3 PSO2-2         6. Explain with a neat block diagram the working of Adaptive Equalizers.       CO5         10 hrs       PO1-3 PSO2-2         9. Frequency Hopped SS, Processing Gain, Interference, and probability of error statement only. PN sequences for Spread Spectrum – M- sequences with Properties; Gold, Kasami only. PN sequences for Spread Spectrum – M- sequences with Properties; Gold, Kasami only. PN sequences for Spread Spectrum system concepts, Frequency Hopped Spread spectrum system concepts, Spread Spectrum Synchronization pO2-2	5 Derive the expressions for error probability for Foremeters: Digital Transmission	
Notice Band limited channels - Inter Symbol Interference Viterion (statement only), Sine10 hrsthrough Band limited ideal channel with zero ISI – Nyquist Criterion (statement only), Sine10 hrsand Raised pulse shaping.Signal design for Band limited channel with controlled ISI – Correlative coding, DB andPO1-3Signal design for Band limited channel with controlled ISI – Correlative coding, DB andPO1-3PO2-2MDB, Pre-coding. Basic Concepts of Equalization for non-ideal channels – ZFE, MMSE,PO4-1(without derivations), Adaptive Equalizers (Block diagram only) (Text 2, Ref 2).PO4-1(Without derivations), Adaptive Equalizers (Block diagram only) (Text 2, Ref 2).PO1-3(Without derivations), Adaptive Equalizers (Block diagram only) (Text 2, Ref 2).PO1-2(Without derivations), Adaptive Equalizers (Block diagram only) (Text 2, Ref 2).PO1-3(Without derivations), Adaptive Equalizers (Block diagram to and Raised pulse shaping.PO1-3(Without derivations), Adaptive Equalization for non-ideal channels – ZFE,PO1-3(Without a neat block diagram the working of Adaptive Equalizers.PSO1-3(MSE.Explain with a neat block diagram the working of Adaptive Equalizers.PO5-2(Nodule 5: Two port network parametersPrinciples of Spread Spectrum: Concept of Spread Spectrum, Direct Sequence/SS, Frequency Hopped SS, Processing Gain, Interference, and probability of error statement only. PN sequences for Spread Spectrum – M- sequences with Properties; Gold, Kasami sequences with basic properties. Direct sequence spread spectrum system concepts, PO2-2PO1-3PO1-3PO2-2PO3-1PO2-2PO	Module 4: Communication through Band Eminted Interference, Eye diagrams, Signal design	CO4
Initial of the second sectorPO1-3 PO2-2 PO3-1 PO4-1in Raised pulse shaping. Signal design for Band limited channel with controlled ISI – Correlative coding, DB and Signal design for Band limited channel with controlled ISI – Correlative coding, DB and MDB, Pre-coding. Basic Concepts of Equalization for non-ideal channels – ZFE, MMSE, (without derivations), Adaptive Equalizers (Block diagram only) (Text 2, Ref 2). (Without derivations), Adaptive Equalizers (Block diagram only) (Text 2, Ref 2). (Without derivations), Adaptive Equalizers (Block diagram only) (Text 2, Ref 2). (Without derivations), Adaptive Equalizers (Block diagram only) (Text 2, Ref 2). (Derive the expression for Sine and Raised pulse shaping. 2. Derive the expression for Sine and Raised pulse shaping. 3. Apply the concepts of DB and MDB, Pre-coding. 4. Explain the Basic Concepts of Equalization for non-ideal channels – ZFE, MMSE. 5. Explain with a neat block diagram the working of Adaptive Equalizers.PS01-3 PO2-2 PO3-1 PO1-2Module 5: Two port network parameters Principles of Spread Spectrum: Concept of Spread Spectrum, Direct Sequence/SS, Frequency Hopped SS, Processing Gain, Interference, and probability of error statement only. PN sequences for Spread Spectrum – M- sequences with Properties; Gold, Kasami only. PN sequences for Spread Spectrum – M- sequences spread spectrum system concepts, PO2-2 PO3-1 PO2-2 PO3-1 PO3-1 PO4-1PO1-3 PO2-2 PO3-1 PO3-1 PO3-1 PO4-1PO1-3 PO3-1 PO3-1 PO4-1PO1-3 PO3-1 PO4-1PO1-3 PO3-1 PO4-1PO3-1 PO4-1PO4-1 PO4-1PO3-1 PO4-1PO4-1PO3-2 PO3-1 PO3-1 PO4-1PO4-1PO3-1 PO4-1PO4-1PO3-1 PO4-1	through Band limited channels - Inter Symbol Interterion (statement only), Sinc	10 hrs
101 Baile of Band101 Baileand Raised pulse shaping.101 BaileSignal design for Band limited channel with controlled ISI – Correlative coding, DB and101 POSignal design for Band limited channel with controlled ISI – Correlative coding, DB andPO2-2MDB, Pre-coding.Basic Concepts of Equalization for non-ideal channels – ZFE, MMSE,(without derivations), Adaptive Equalizers (Block diagram only) (Text 2, Ref 2).PO3-1(without derivations), Adaptive Equalizers (Block diagram only) (Text 2, Ref 2).PO4-1(Without derivations), Adaptive Equalizers (Block diagram only) (Text 2, Ref 2).PO1-2(LO: At the end of this session the student will be able toPO1-22. Derive the expression for Sinc and Raised pulse shaping.PO1-33. Apply the concepts of DB and MDB, Pre-coding.PS01-34. Explain the Basic Concepts of Equalization for non-ideal channels – ZFE, MMSE.PS01-35. Explain with a neat block diagram the working of Adaptive Equalizers.PS02-26. Module 5: Two port network parameters Principles of Spread Spectrum: Concept of Spread Spectrum, Direct Sequence/SS, Frequency Hopped SS, Processing Gain, Interference, and probability of error statement only. PN sequences for Spread Spectrum – M- sequences with Properties; Gold, Kasami sequences with basic properties. Direct sequence spread spectrum system concepts, PO2-2PO1-3PO2-2PO3-1PO4-1PO3-1PO4-1PO4-1PO3-1PO4-1PO4-1	for Band limited ideal channel with zero ISI = hydride	PO1-3
and realiser       For Band limited channel with control of the one-ideal channels – ZFE, MMSE,       For Basic Concepts of Equalization for non-ideal channels – ZFE, MMSE,         MDB, Pre-coding. Basic Concepts of Equalization for non-ideal channels – ZFE, MMSE,       PO3-1         (without derivations), Adaptive Equalizers (Block diagram only) (Text 2, Ref 2).       PO4-1         (without derivations), Adaptive Equalizers (Block diagram only) (Text 2, Ref 2).       PO3-1         (without derivations), Adaptive Equalizers (Block diagram only) (Text 2, Ref 2).       PO3-2         (without derivations), Adaptive Equalizers (Block diagram only) (Text 2, Ref 2).       PO3-1         (without derivations), Adaptive Equalizers (Block diagram only) (Text 2, Ref 2).       PO3-1         (without derivations), Adaptive Equalizers (Block diagram only) (Text 2, Ref 2).       PO1-3         (b) Explain the concept of Inter Symbol Interference, Eye diagrams.       PO3-1         (b) Explain with a neat block diagram the working of Adaptive Equalizers.       PS01-3         (c) Explain with a neat block diagram the working of Adaptive Equalizers.       PS02-2         (c) Module 5: Two port network parameters       Principles of Spread Spectrum: Concept of Spread Spectrum, Direct Sequence/SS,       PO1-3         Principles of Spread Spectrum – M- sequences with Properties; Gold, Kasami       PO1-3         PO2-2       PO3-1       PO4-1         PO3-1       PO4-1       PO4-1 </td <td>and Baised pulse shaping.</td> <td>PO2-2</td>	and Baised pulse shaping.	PO2-2
Signal design       Basic Concepts of Equalization for non-ideal channels – ZFE,       PO4-1         (without derivations), Adaptive Equalizers (Block diagram only) (Text 2, Ref 2).       PO4-1         (without derivations), Adaptive Equalizers (Block diagram only) (Text 2, Ref 2).       PO4-1         LO: At the end of this session the student will be able to       PO12-2         1. Explain the concept of Inter Symbol Interference, Eye diagrams.       PO12-2         2. Derive the expression for Sinc and Raised pulse shaping.       PS01-3         3. Apply the concepts of DB and MDB, Pre-coding.       PS02-2         4. Explain the Basic Concepts of Equalization for non-ideal channels – ZFE,       PS02-2         MMSE.       Sexplain with a neat block diagram the working of Adaptive Equalizers.       CO5         Module 5: Two port network parameters       Principles of Spread Spectrum: Concept of Spread Spectrum, Direct Sequence/SS,       10 hrs         Frequency Hopped SS, Processing Gain, Interference, and probability of error statement       PO1-3         pO2-2       PO2-2       PO1-3         po2-2       PO1-3       PO2-2         po3-1       PO4-1       PO4-1         PO3-2       PO3-1       PO4-1	signal design for Band limited channel with controlled non-ideal channels – ZFE, MMSE,	PO3-1
MDB, the evolutions), Adaptive Equalizers (Block diagram body to without derivations), Adaptive Equalizers (Block diagram body to without derivations), Adaptive Equalizers (Block diagrams.       PO5-2         LO: At the end of this session the student will be able to       PO12-2         1. Explain the concept of Inter Symbol Interference, Eye diagrams.       PS01-3         2. Derive the expression for Sine and Raised pulse shaping.       PS01-3         3. Apply the concepts of DB and MDB, Pre-coding.       PS02-2         4. Explain the Basic Concepts of Equalization for non-ideal channels – ZFE, MMSE.       PS02-2         5. Explain with a neat block diagram the working of Adaptive Equalizers.       CO5         Module 5: Two port network parameters       Principles of Spread Spectrum: Concept of Spread Spectrum, Direct Sequence/SS, Principles of Spread Spectrum – M- sequences with Properties; Gold, Kasami only. PN sequences for Spread Spectrum – M- sequences with Properties; Gold, Kasami sequences with basic properties. Direct sequence spread spectrum system concepts, PO2-2       PO1-3         Frequency Hopped Spread spectrum system concepts, Spread Spectrum Synchronization (Hopped Spread spectrum system concepts, Spread Spectrum Synchronization (Feak diagram treatment) - Code Acquisition and Tracking. (Text 2)       PO1-3	Signal deciging. Basic Concepts of Equalization for any only) (Text 2, Ref 2).	PO4-1
Image: Construction of this session the student will be able toPO12-2LO: At the end of this session the student will be able toPO12-21. Explain the concept of Inter Symbol Interference, Eye diagrams.PS01-32. Derive the expression for Sinc and Raised pulse shaping.PS01-33. Apply the concepts of DB and MDB, Pre-coding.PS02-24. Explain the Basic Concepts of Equalization for non-ideal channels – ZFE, MMSE.PS02-25. Explain with a neat block diagram the working of Adaptive Equalizers.CO5Module 5: Two port network parameters Principles of Spread Spectrum: Concept of Spread Spectrum, Direct Sequence/SS, Frequency Hopped SS, Processing Gain, Interference, and probability of error statement only. PN sequences for Spread Spectrum – M- sequences with Properties; Gold, Kasami sequences with basic properties. Direct sequence spread spectrum system concepts, Frequency Hopped Spread spectrum system concepts, Spread Spectrum Synchronization (Frequency Hopped Spread spectrum system concepts, Spread Spectrum Synchronization (Forek diagram treatment) - Code Acquisition and Tracking. (Text 2)PO1-3	(without derivations), Adaptive Equalizers (Block diagram by the able to	PO5-2
LO: At the concept of Inter Symbol Interference, D) = 0 = 0       PSO1-3         1. Explain the concepts of DB and MDB, Pre-coding.       PSO1-3         2. Derive the expression for Sinc and Raised pulse shaping.       PSO2-2         3. Apply the concepts of DB and MDB, Pre-coding.       PSO2-2         4. Explain the Basic Concepts of Equalization for non-ideal channels – ZFE, MMSE.       PSO2-2         5. Explain with a neat block diagram the working of Adaptive Equalizers.       CO5         Module 5: Two port network parameters       Io hrs         Principles of Spread Spectrum: Concept of Spread Spectrum, Direct Sequence/SS, Principles SS, Processing Gain, Interference, and probability of error statement       Io hrs         Frequency Hopped SS, Processing Gain, Interference, spread spectrum system concepts, Spread Spectrum Synchronization       PO1-3         PO2-2       PO3-1       PO3-1         Frequency Hopped Spread spectrum system concepts, Spread Spectrum Synchronization       PO3-1         PO3-1       PO4-1       PO4-1	to the end of this session the student will be able to	PO12-2
<ol> <li>Explain the expression for Sine and Raised parent of the expression for Sine and Raised parent of the expression for Sine and Raised parent of the explain the sequences of DB and MDB, Pre-coding.</li> <li>Apply the concepts of DB and MDB, Pre-coding.</li> <li>Explain the Basic Concepts of Equalization for non-ideal channels – ZFE, MMSE.</li> <li>Explain with a neat block diagram the working of Adaptive Equalizers.</li> <li>Explain with a neat block diagram the working of Adaptive Equalizers.</li> <li>Explain with a neat block diagram the working of Adaptive Equalizers.</li> <li>Explain with a neat block diagram the working of Adaptive Equalizers.</li> <li>Module 5: Two port network parameters</li> <li>Principles of Spread Spectrum: Concept of Spread Spectrum, Direct Sequence/SS, Principles of Spread Spectrum – M- sequences with Properties; Gold, Kasami only. PN sequences for Spread Spectrum – M- sequences with Properties; Gold, Kasami sequences with basic properties. Direct sequence spread spectrum system concepts, PO2-2 PO3-1 PO3-1 PO4-1</li> <li>Heak diagram treatment) - Code Acquisition and Tracking. (Text 2)</li> </ol>	LO: At the concept of Inter Symbol Interference, Dy	
<ul> <li>Apply the concepts of DB and MDB, fitter of non-ideal channels – ZFE,</li> <li>Explain the Basic Concepts of Equalization for non-ideal channels – ZFE,</li> <li>Explain the Basic Concepts of Equalization for non-ideal channels – ZFE,</li> <li>MMSE.</li> <li>Explain with a neat block diagram the working of Adaptive Equalizers.</li> <li>Explain with a neat block diagram the working of Adaptive Equalizers.</li> <li>Explain with a neat block diagram the working of Adaptive Equalizers.</li> <li>Explain with a neat block diagram the working of Adaptive Equalizers.</li> <li>Module 5: Two port network parameters</li> <li>Principles of Spread Spectrum: Concept of Spread Spectrum, Direct Sequence/SS,</li> <li>Principles of Spread Spectrum – M- sequences with Properties; Gold, Kasami only. PN sequences for Spread Spectrum – M- sequence spread spectrum system concepts, sequences with basic properties. Direct sequence spread spectrum system concepts, PO2-2</li> <li>Frequency Hopped Spread spectrum system concepts, Spread Spectrum Synchronization PO3-1</li> <li>Frequency Hopped Spread spectrum system concepts, Cast and Tracking. (Text 2)</li> </ul>	2 Derive the expression for Sinc and Kaised public and the second more and MDB Pre-coding.	PSO1-3
<ul> <li>4. Explain the Basic Concepts of Equation of Adaptive Equalizers.</li> <li>5. Explain with a neat block diagram the working of Adaptive Equalizers.</li> <li>5. Explain with a neat block diagram the working of Adaptive Equalizers.</li> <li>6. Explain with a neat block diagram the working of Adaptive Equalizers.</li> <li>7. Explain with a neat block diagram the working of Adaptive Equalizers.</li> <li>7. Explain with a neat block diagram the working of Adaptive Equalizers.</li> <li>8. Explain with a neat block diagram the working of Adaptive Equalizers.</li> <li>8. Explain with a neat block diagram the working of Adaptive Equalizers.</li> <li>9. Explain with a neat block diagram teatment.</li> <li>9. Frequency Hopped Spread Spectrum – M- sequences spread spectrum System concepts, spread Spectrum Synchronization PO3-1</li> <li>9. Frequency Hopped Spread spectrum system concepts, Spread Spectrum Synchronization PO3-1</li> <li>9. Code Acquisition and Tracking. (Text 2)</li> </ul>	3. Apply the concepts of DB and MDD, the non-ideal channels – ZFE,	PSO2-2
MMSE.5. Explain with a neat block diagram the working of Adaptive Equalizers.CO55. Explain with a neat block diagram the working of Adaptive Equalizers.I0 hrs6. Module 5: Two port network parametersI0 hrs9. Principles of Spread Spectrum: Concept of Spread Spectrum, Direct Sequence/SS, Prequency Hopped SS, Processing Gain, Interference, and probability of error statement only. PN sequences for Spread Spectrum – M- sequences with Properties; Gold, Kasami sequences with basic properties. Direct sequence spread spectrum system concepts, spread Spectrum SynchronizationPO1-3 PO2-2 PO3-1 PO3-1 PO4-1	4. Explain the Basic Concepts of Equation	
5. Explain with a near block energy       5. Explain with a near block energy       6000         Module 5: Two port network parameters       10 hrs         Principles of Spread Spectrum: Concept of Spread Spectrum, Direct Sequence/SS, Processing Gain, Interference, and probability of error statement       10 hrs         Frequency Hopped SS, Processing Gain, Interference, and probability of error statement       PO1-3         only. PN sequences for Spread Spectrum – M- sequence spread spectrum system concepts, sequence spread spectrum system concepts, PO2-2       PO2-2         Frequency Hopped Spread spectrum system concepts, Spread Spectrum Synchronization       PO3-1         Frequency Hopped Spread spectrum system concepts, Code Acquisition and Tracking. (Text 2)       PO4-1	MMSE.	C05
Module 5: Two port network parametersInterferencePrinciples of Spread Spectrum: Concept of Spread Spectrum, Direct Sequence/SS, Principles of Spread Spectrum: Concept of Spread Spectrum, Direct Sequence/SS, Prequency Hopped SS, Processing Gain, Interference, and probability of error statement only. PN sequences for Spread Spectrum – M- sequences with Properties; Gold, Kasami sequences with basic properties. Direct sequence spread spectrum system concepts, Spread Spectrum SynchronizationPO1-3 PO2-2 PO3-1 PO3-1Frequency Hopped Spread spectrum system concepts, Spread Spectrum Synchronization (black diagram treatment) - Code Acquisition and Tracking. (Text 2)PO4-1	5. Explain with a near block and	
Principles of Spread Spectrum. Conterport         Frequency Hopped SS, Processing Gain, Interference, and probability of error statement         Frequency Hopped SS, Processing Gain, Interference, and probability of error statement         only. PN sequences for Spread Spectrum – M- sequence spread spectrum system concepts,         sequences with basic properties. Direct sequence spread spectrum Synchronization         Frequency Hopped Spread spectrum system concepts, Spread Spectrum Synchronization         Frequency Hopped Spread spectrum system concepts, Concepts,         Frequency Hopped Spread spectrum system concepts,         Frequency Hopped Spread spectrum system concepts,         PO3-1         PO4-1	Module 5: Two port network parameters	10 hrs
Frequency Hopped SS, Processing Gain, Interferences with Properties; Gold, Kasami only. PN sequences for Spread Spectrum – M- sequences with Properties; Gold, Kasami pO2-2 pO2-2 pO3-1 Frequency Hopped Spread spectrum system concepts, Spread Spectrum Synchronization PO3-1 PO4-1PO1-3 PO2-2 PO3-1 PO4-1	Principles of Spread Spectrum, Compression Interference, and probability of error statemen	:
only. PN sequences for Spread Spectrum – Mª sequences as spectrum system concepts, sequences with basic properties. Direct sequence spread spectrum SynchronizationPO2-2 PO3-1 PO3-1 PO4-1Frequency Hopped Spread spectrum system concepts, Care diagram treatment) - Code Acquisition and Tracking. (Text 2)PO4-1	Frequency Hopped SS, Processing Gain, interferences with Properties; Gold, Kasam	PO1-3
sequences with basic properties. Direct sequence spread spectrum Synchronization PO3-1 Frequency Hopped Spread spectrum system concepts, Spread Spectrum Synchronization PO4-1	only PN sequences for Spread Spectrum - M- sequences spread spectrum system concepts	PO2-2
Frequency Hopped Spread spectrum system concepts, Spread Spectrum Optimited PO4-1 (block diagram treatment) - Code Acquisition and Tracking. (Text 2)	sequences with basic properties. Direct sequence spread spectrum Synchronization	n PO3-1
(block diagram treatment) - Code Acquisition and Tracking. (Text 2)	Erecuency Hopped Spread spectrum system concepts, Spread Spectrum Officer 2)	PO4-1
	(block diagram treatment) - Code Acquisition and Tracking. (Text 2)	

LO: At the end of this session the student will be able to	PO5-1
<ol> <li>Explain the Concept of Spread Spectrum Modulation.</li> <li>Explain the different types of Spread Spectrum Modulation.</li> <li>Explain the properties and apply the concepts of PN sequence generation.</li> <li>Explain the Concept of Frequency Hopped Spread spectrum system. (http://doi.org/10.1016)</li> <li>Explain the working of Code Acquisition and Tracking with a neat block diagram.</li> </ol>	PO6-2 PO12-2
Text Books	404
<ol> <li>Simon Haykin, "Digital Communication Systems", John Wiley &amp; sons, First Edition 978-0-471-64735-5.</li> <li>John G Proakis and Masoud Salehi, "Fundamentals of Communication Systems" Pearson Education, ISBN 978-8-131-70573-5.</li> </ol>	n, 2014, ISBN ', 2014 Edition,
Reference Books	11111
<ol> <li>Ian A Glover and Peter M Grant, "Digital Communications", Pearson Education, T 2010, ISBN 978-0-273-71830-7.</li> <li>P. P. Lutting, 1993 (2019)</li> </ol>	hird Edition,
<ol> <li>B.P.Lathi and Zhi Ding, "Modern Digital and Analog communication Systems", Op Press, 4<sup>th</sup> Edition, 2010, ISBN: 978-0-198-07380-2.</li> <li>Wayne, Tomasi, Advanced Elements 10, 100 (2010)</li> </ol>	cford University
<ul> <li>4. Dr. Saniay Sharma Communication System Acales and Divid Market Communication System.</li> </ul>	arson education
Useful Websites • http://freevideolectures.com/Course/2311/Digital-Communication • https://onlinecourses.nptel.ac.in/explorer • http://nptel.iitg.ernet.in/	012.
<ul> <li>Useful Journals</li> <li>Communications Magazine, IEEE (<u>http://ieeexplore.ieee.org/</u>)</li> <li>Journal of the Institution of Electronic and Radio Engineers (<u>http://digital-library.theiet.org/content/journals/ecej</u>)</li> <li>International Journal of Communication Systems (<u>http://onlinelibrary.wiley.com/</u>)</li> <li>AEU - International Journal of Electronics and Communications (<u>http://www.journals.elsevier.com/aeu-international-journal-of-electronics-and-com</u></li> </ul>	nmunications/)
<ul> <li>Digital Communications and Networks (<u>http://www.journals.elsevier.com/digital-cand-networks/</u>)</li> </ul>	communications-
Teaching and Learning Methods	
1. Lecture class: 50 hrs	
Assessment	
Type of test/examination: Written examination	
Continuous Internal Evaluation(CIE): 40 marks (Average of three tests and assignment	ts will be
considered )	
Semester End Exam(SEE) : 100 marks (students have to answer all main questions) which	ch will be reduced
to 60 Marks.	
Test duration: 1:30 hrs	
Examination duration: 3 hrs	

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### CO to PO Mapping

PO1: Science and engineering Knowledge	
PO2: Problem Analysis	
PO3: Design & Development	
PO4: Investigations of Complex Problems	
PO5: Modern Tool Usage	
PO6: Engineer & Society	_

PO7:Environment and Sustainability PO8: Ethics PO9:Individual & Team Work PO10: Communication PO11:Project Mngmt & Finance PO12:Life long Learning

At the end of the Program, the students should:

PSO1: Be able to acquire knowledge and apply concepts in the field of engineering and interdisciplinary subjects.

PSO2: Be able to identify the existing problems, effectively utilize tools to provide solution, and disseminate the information.

	РО	PO1	PO2	PO3	РО 4	PO5	PO6	РО 7	PO8	PO9	PO10	PO1 1	PO12	PS O1	P O 2	1
I	K-level						-								$\square$	
-	К3	3	2	1	1	1		-	-	-	-	-	2	3	2	
-	К3	3	2	1	1	2	-	-	-	-	- 1	-	2	3	2	
+	K2	3	2	1	1	2	2	-	-	-	-	-	2	3	2	
4	1/2		2	1	1	2		· ·	<u> </u>	-	-	-	2	3	2	
	K.3	3	2	1	1	2		-					2	3	2	
Ι	K3	3	2	1	1	1	2	-	-	-		-	2		2	1

Course In charge

Head of the Department

pt. of Electronics & Communication Engineering K. S. School of Engineering & Management Bangalore-560 109 ۰.

**IQAC** Coordinator Principal

Dr. K. RAMA NARASIMHA Principal/Director K S School of Engineering and Manager Bengaluru - 560 109

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#### K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109 DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING SESSION: 2021–2022 (EVEN SEMESTER) CO-PO Mapping

Course	: Power System	m Operation and Control						
Type: (	Type: Core Course Code: 18EE81							
No of Hours								
(Lee	Theory ture Class)	Practical/Field Work/Allied Activities	Total	hours/Week Total		eaching hours		
	3	0	_	3		40		
			Mark	S				
Inter	nal Assessment	Examination		Total		Credits		
	40	60		100		3		
Aim/O	bjectives of the	Course						
<ol> <li>To</li> <li>To</li> <li>To</li> <li>mat</li> <li>To</li> <li>syst</li> <li>To</li> </ol>	<ol> <li>To discuss various levels of controls in power systems and the vulnerability of the system.</li> <li>To explain components, architecture and configuration of SCADA.</li> <li>To explain basic generator control loops, functions of Automatic generation control, speed governors and mathematical models of Automatic Load Frequency Control.</li> <li>To explain automatic generation control, voltage and reactive power control in an interconnected power system.</li> </ol>							
Course	Learning Out	comes						
After co	ompleting the c	ourse, the students will be a	ble to					
CO1	Explain vario and classificat	us levels of controls in Pow ions of SCADA.	er Syste	ms and discuss	the architecture	Understanding (K2)		
CO2	Develop the c	omplete load frequency con	trol mod	el of an isolated	power system.	Applying (K3)		
CO3	Develop math system. Auto control area.	nematical models of Autor matic Voltage Regulator a	natic Ge and calc	eneration Contr culate different	ol in two area parameters of	Applying (K3)		
CO4	Derive the rel voltage contro	ation between voltage, pow I methods and calculate vol	er, react tage and	ive power at a 1 reactive power	node along with of system.	Applying (K3)		
<b>0</b> 5	Derive an exp analysis and st	ression for change in netwo tate vector by linear Least So	ork parar quare est	neters required timation method	for contingency ls.	Applying (K3)		
Syllabus Content								
Module Concep Manage Superv applicat system, Classifi RTU, M	<u>e 1</u> : Introducti ts of Reliablement Centers. isory Control tion in Power S components of ication of SCA Multiple master	ion: Operating States of Pow e Operation, Preventive and Data acquisition ( ystem, basic functions and a "RTU, communication subsy DA System: Single master -multiple RTUs, and Singl	ver Syste and E (SCADA advantag ystem, II –single 1 e master	em, Objectives Emergency Co A): Introduction es, Building blo ED functional b remote, Single r, multiple sub	of Control, Key ntrols, Energy n, components, ocks of SCADA lock diagram. master-multiple naster, multiple	CO1 8 hrs PO1-3 PO6-2 PO12 -1 PSO1-3 PSO2-1		

<ul> <li>LO: After completing these chapters, students will be able to <ol> <li>Discuss Operating States and reliable operation in Power System.</li> <li>Illustrate Preventive and emergency control in Power System.</li> <li>Explain the components, configurations and application of SCADA system.</li> <li>Draw the IED functional block diagram and Common communication channed used.</li> <li>Classify SCADA System and illustrate each type with neat diagram.</li> </ol> </li> <li>Module-2: Automatic Generation Control (AGC): Introduction, Schematic diagram load frequency and excitation voltage regulators of turbo generators, Load frequency control (Single area case). Turbine speed governing system, Model of speed governing system, Turbine model. Generator load model, Complete block diagram of representation of load frequency control of an isolated power system, Steady state analysis, Control are concept. Proportional plus Integral Controller.</li> <li>LO: After completing these chapters, students will be able to <ol> <li>Explain basic AVR and ALFC control loop of Generator.</li> <li>Obtain the functional speed – governor model of an ALFC for isolated power system.</li> <li>Develop mathematical modelling of Speed governing system, Turbine, Generator and load.</li> <li>Develop complete block diagram of single control area having a turbo – generator supplying an isolated load for load frequency problem and discuss the response of the system for a sudden change in load demand.</li> </ol> </li> </ul>	els of cy ng on ea CO2 8hrs. PO1-3 PO2-2 er PO3-2 PO6-2 or PO12-1 PSO1-3 or PSO2-2 of e
<ul> <li>Secondary ALFC loop parameter for control and explain orderly and Secondary ALFC loop with control specification and Proportional integra controller.</li> <li><u>Module-3:</u> Automatic Generation Control in Interconnected Power system: Two are load frequency control. Optimal (Two area) load frequency control by state variable Automatic voltage control, Load frequency control with generation rate constraint (GRCs). Speed governor dead band and its effect on AGC, Digital LF Controllers Decentralized control.</li> <li>LO: After completing these chapters, students will be able to <ol> <li>Derive the expression for tie – line power and frequency deviation for two area system.</li> <li>Develop the two-area load frequency model of two system interconnected by a tigline and obtain the state variable model of two area system.</li> <li>Derive mathematical modelling of AVR with neat block diagram and list the requirements of good AVR system.</li> </ol> </li> </ul>	a s s PO1-3 PO2-2 PO3-2 PO3-2 PO3-2 PO12-1 PO12-1 PO12-1 PO12-1 PO12-1 PO12-2 PO12-1 PO12-2 PO12-1 PO12-2 PO12-1 PO12-2 PO12-1 PO12-2 PO12-1 PO12-2 PO12-1 PO12-2 PO12-1 PO12-2 PO12-1 PO12-2 PO12-1 PO12-2 PO12-1 PO12-2 PO12-1 PO12-2 PO12-1 PO12-2 PO12-1 PO12-2 PO12-1 PO12-2 PO12-1 PO12-2 PO12-1 PO12-2 PO12-2 PO12-1 PO12-2 PO12-2 PO12-2 PO12-2 PO12-2 PO12-1 PO12-2
<ul> <li>band in Speed governor control loop.</li> <li>5. Explain Digital LF Controllers and Decentralized control in AGC strategies.</li> <li>Module-4: Control of Voltage and Reactive Power: Introduction, Generation and absorption of reactive power, Relation between voltage, power and reactive power at a node, Methods of voltage control: i. Injection of reactive power. Shunt capacitors and reactors. Series capacitors, Synchronous compensators, Series injection. ii Tap changing transformers. Combined use of tap changing transformers and reactive power injection. Booster transformers, Phase shift transformers, Voltage collapse.</li> </ul>	

LO:	After completing d							
	completing these chapters, students will be able to							
1.	Explain the communication	CO4						
	power	8hrs						
2.	Derive the equations to get the relation become to	PO1-3						
	at a node	PO2-2 PO3-2						
3.	Calculate real and reactive power delivered by the generator in a transmission	PO6-2						
	network.	PO12-1						
4.	Explain different Voltage Control methods with next diagram	PSO1-3						
5.	Write short note on voltage collapse	PSO2-2						
Mo sect Cor Sta LO €. 2. 3 4 5	<ul> <li>dule-5: Power System Security: Introduction, Factors affecting power system arity. Contingency Analysis, Linear Sensitivity Factors, AC power flow methods, ntingency Selection and Ranking.</li> <li>te estimation of Power Systems: Introduction, Linear Least Square Estimation.</li> <li>e: After completing these chapters, students will be able to</li> <li>Derive an expression for contingency selection by calculating the performance index, network sensitivity factor and contingency ranking.</li> <li>Explain major functions involved in system security.</li> <li>Explain contingency analysis procedure with flow chart.</li> <li>Define state estimation and explain the objectives, issues and process of power system state estimation.</li> </ul>	CO5 8hrs PO1-3 PO2-2 PO6-2 PO12-1 PSO1-3 PSO2-1						
Te	ext Books:							
1								
1 2 3	<ol> <li>Modern Power System Analysis, D. P. Kothari, McGraw Hill, 4<sup>th</sup> Edition, 2011.</li> <li>Power Generation Operation and Control, Allen J Wood &amp; <i>Woollenberg</i>. Wiley ,2<sup>nd</sup> Ed.</li> <li>Electric Power Systems, B M Weedy, B J Cory, Wiley, 4<sup>th</sup> Edition, 2012.</li> </ol>	lition, 2003.						
Re	eference Books:							
	<ul> <li>Computer-Aided Power System Analysis, G. L. Kusic, CRC Press, 2nd Edition.2010</li> <li>Power System SCADA and Smart Grid, Mini S Thom and John D. McDonald, CRC Press, 2015</li> <li>Power System Stability and Control, Kundur, McGraw Hill, 8<sup>th</sup> Reprint, 2009</li> </ul>							
U	seful Websites							
	<ol> <li>https://www.youtube.com/watch?v=D7nUa7zRPa4</li> <li>https://www.youtube.com/watch?v=zkN130mgGOs</li> <li>https://nptel.ac.in/courses/108/104/108104052/</li> <li>https://www.youtube.com/watch?v=1K_j_3ZJwuk</li> <li>https://nptel.ac.in/courses/108/101/108101040/</li> </ol>							

#### **Useful Journals**

- International Journal of Engineering Trends and Technology (IJETT): http://www.ijettjournal.org/2017/volume-43/number-4/LIETT-V43P232.pdf
- International Electrical Engineering Journal (IEEJ): <u>https://www.researchgate.net/profile/AlmoatazAbdelaziz/publication/306120177\_Optimal\_Power\_Flow\_Methods\_A\_Comprehensive\_Comprehensive\_Survey/links/57b3059b08aee0b132d8ceb1/Optimal-Power-Flow-Methods-A\_Comprehensive\_Survey.pdf</u>

Teaching and Learning Methods: Lecture class: 40 hours

#### Assessment

Type of test/examination: Written examination

**Continuous Internal Evaluation (CIE)**: 40 marks (30 marks -Average of three tests + 10 marks Assignments) **Semester End Exam (SEE)**: 100 marks (students have to answer all main questions) which will be reduced to 60 Marks.

Test duration: 1:30 hours

**Examination duration:** 3 hours

CO to PO Mapping									
PO1: Science and engineering Knowledge	PO7: Environment and Society								
PO2: Problem Analysis	PO8: Ethics								
PO3: Design & Development	PO9: Individual & Team Work								
PO4: Investigations of Complex Problems	PO10: Communication								
PO5: Modern Tool Usage	PO11: Project Management & Finance								
PO6: Engineer & Society	PO12: Lifelong Learning								

**PSO1:** Graduates should be able to develop an inclination towards acquiring analytical, technical, managerial and communicative skills by gaining knowledge in fundamental concepts in the field of Electrical sciences and allied subjects.

**PSO2:** Graduates should be able to Contribute for the development of society by providing technical solutions to complex electrical engineering problems through life-long learning.

CO	РО	PO 1	PO 2	РО 3	РО 4	РО 5	PO 6	РО 7	РО 8	PO 9	PO 10	РО 11	PO 12	PSO 1	PSO 2
18EE81	K- level														
CO1	K2	3	-		-	-	2	-	-	-	-	-	1	3	1
CO2	K3	3	2	2	-	-	2	-	-	-	-	-	1	3	2
CO3	K3	3	2	2	-	-	2	-	<u>-</u>	-	-	-	1	3	2
CO4	K3	3	2	2	-	-	2	-	-	-	-	-	1	3	2
CO5	K3	3	2	-	-	-	2		-	-	-		1	3	1

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**IQAC-**Coordinator

Principal



# K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109

DEPARTMENT OF MANAGEMENT STUDIES

**CO-PO Mapping** 

Cours	se: FINANC	IAL N	IANAGEMENT			
Туре:	CORE			Course Code: 20M	BA22	
		1	No	o of Hours		
(Lecture Class) Activities				Total/Week	Total teachi	ng hours
	3		2	5 Marilia	52	
Inter	nal Assessme	ent	Examination		Cr	edits
men	40		<u>60</u>	100		3
Aim/	Objectives	of the	Course			
1. To f	amiliarize the	studen	ts with basic concepts of fir	nancial management and fina	ancial system.	
2. To u	inderstand cor	ncept of	f time value of money and i	ts implication.		
3. To e	evaluate the in	vestme	nt proposals.			
4. To u	inderstand the	manag	ement of working capital in	n an organization.		
5. To a	nalyse capital	structi	and dividend decision.	-		
Cours	se Learning	Outco	omes	able to:		
Aner	completing t	ne cou	rse, the students will be			
COI	Understa	nd the	basic financial concep	pts		Understandin g (K1)
	Apply tim	ne valu	ue of money			
CO2			·			Applying (K3)
	Evaluate	the C	ost of Capital			Applying (K3)
CO3						· · · · · · · · · · · · · · · · · · ·
	Evaluate	the in	vestment decisions			Applying (K3)
CO4						Applying (ite)
	Estimate	worki	ng capital requirement	ts		
CO5	Louinate					Applying (K3)
			ital atmisture and divi	dend decisions		
<u> </u>	Analyze t	ne cap	ontal structure and divi			Applying (K3
006						
			Syl	labus Content		
Unit	1. (7 Hou	rs) I	troduction : Mean	ing and objectives	of Financial	
Man	$1. (7 \mathbf{110u})$	chon	ning role of finance	managers. Interfac	e of Financial	
Mana	agement,	unang :+h	other functional	areas Indian Finat	ncial System:	CO1
Mana	agement	with	ouner functional	Financial institutions	s and financial	
Finan	cial marke	ts, F	mancial instruments,	Management Risk	Management.	07 hrs
servic	es. Emerg	ing i	Ssues in Financial	Nallagement. Risk	Theory)	
Beha	vioural F	inanc	e, Financial Engin	cernig, Derivatives (1		PSO1, PO3, PO PSO1, PSO2
	At the end of	this s	ession the student will b	be able to		
1	Describe	the si	gnificance of Financi	ial Management.		
LO: A 1.	At the end of Describe	this s the si	ession the student will b gnificance of Financi	be able to ial Management.		

## K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109



DEPARTMENT OF MANAGEMENT STUDIES

### **CO-PO Mapping**

2. Explain Emerging issues in Financial Management?	
3. Write short note on Derivatives.	
4. Describe all Money Market Instruments?	
5. Explain Capital Market?	
Unit 2: (10 Hours) Time value of money :	
Meaning of Time value of money –Future value of single cash flow & annuity, present value of single cash flow, annuity & perpetuity. Simple interest & Compound interest, Capital recovery & loan amortization. (Theory & Problem). Case Study on Loan amortization. Computer lab for calculation of future value, present value and loan amortisation in MS excel.	CO2 10 hrs.
$\mathbf{I} \mathbf{O}$ : At the end of this session the student will be able to	PO1,PO2, PO3
1 Define term Time Value of money?	PSO1,PSO2
2 Explain the forms of time value of money.	
3. What is Annuity	
4. Distinguish between Compound Interest and Simple Interest?	
Unit 3: (10 Hours) Sources of Financing:	
Shares, Debentures, Term loans, Lease financing, Hybrid financing, Venture Capital, Angel investing and private equity, Warrants and convertibles (Theory Only). Cost of Capital: Basic concepts. Cost of debenture capital, cost of preferential capital, cost of term loans, cost of equity capital (Dividend discounting and CAPM model) - Cost of retained earnings - Determination of Weighted average cost of capital (WACC) and Marginal cost of capital. (Theory & Problem). Case Study on WACC.	<b>CO3</b> 10 hrs
LO: At the end of this session the student will be able to	PO1,PO2, PO3 PSO1,PSO2
<ol> <li>Define Shares and Debentures?</li> <li>Determine the meaning of Hybrid Financing and Venture Capital.</li> <li>Discuss the Cost of Capital.</li> <li>Explain Dividend Discounting and CAPM Model?</li> </ol>	
Unit 4: (9 Hours) Investment Decisions : Capital budgeting process. Investment	
evaluation techniques – [Net present value. Internal rate of return. Modified	
internal rate of return. Profitability index. Payback period, discounted payback	
period, accounting rate of return Problem). Risk analysis in capital budgeting-Case	CO4
Study on replacement of capital project. (Numerical problems). Computer lab for	01
calculation of NPV, IRR, PI, Payback period, ARR in MS excel.	9nrs
	POL PO3
LO: At the end of this session the student will be able to	PSO1,PSO2
1. Outline the meaning of Net Present Value	
2. Discuss the Capital Budgeting Process.	
3. Explain the Investment Evaluation Techniques.	
Unit 5: (7 Hours) Working Capital Management :	CO5
Factors influencing working capital requirements - Current asset policy and current asset finance policy. Determination of operating cycle and cash cycle on Excel. Estimation	t 7 hrs
Estimation of operating cycle and cash cycle on Excel-Estimation	



K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109

## DEPARTMENT OF MANAGEMENT STUDIES

### **CO-PO Mapping**

of working capital requirements of a family of the second se	1
Management) Case study with the Window of a firm. (Does not include Cash, Inventory & Receivables	PO1,PO3
working capital Determination and the impact of negative	PSO1,PSO2
working capital Amazon-negative working capital and profitability. Computer lab for	
calculation of working capital cycle and operating cycle in MS excel.	
LO: At the end of this session the student will be able to	
1. Explain the Operating Cycle and Cash Cycle	
2 Explain the impact of Net Working Conital	
2. Explain the impact of Net working Capital.	
3. Discuss the factors influencing Working Capital Requirements.	
Unit 6: (7 Hours) Capital structure and dividend decisions :	
Capital structure and dividend decisions – Planning the capital structure-Governance of Equity and	
Debt, Fail in interest rates and perils of Debt funding. Leverages, EBIT and EPS analysis. ROI &	CO-6
ROE analysis. Capital structure policy. Dividend policy – Factors affecting the dividend policy –	7 hrs
Dividend Policies- Stable Dividend, Stable Payout (No dividend theories to be covered). Case Study	/ 1115
on EBIT-EPS analysis & Leverages.	
	PO1, PO2,
<b>LO:</b> At the end of this session the student will be able to	PO4, PO5,
1. Discuss the factors affecting Dividend Policy	PSO1,PSO2
2. How do you coloulate L average?	
2. How do you calculate Leverages?	
3. Write short note on Capital Structure.	
4. What is Debt Financing.	
Text Books	
1. Financial Management by Khan and Jain, 1 MH /e.	
2. Financial Management by Prasanna Chandra, TMH 9e.	
3. Financial Management by Prahlad Rathod, Babitha Thimmiah and Harish Babu, HPH 1e, 2	.015.
4. Financial Management: A Strategic Perspective by Nikhil Chandra Shil & Bhagaban Das	, Sage
Publications,1e,2016	-
Reference Books	
1. Financial Management by I.M. Pandey, Vikas Publishing House Pvt. Ltd. 3e. 2012	
2. Principles of Corporate Finance by Brealey, Myers, Allen and Mohanty, McGraw Educatio	n (India) Private
Limited 11e 2014	
	2 2015
3. Cases in Financial Management by I.M. Pandey and Ramesh Bhat, McGraw-Hill Education	1, 3e, 2015
4. Corporate Finance by Vishwanath S.R., Sage Publications, 3e, 2019	
Useful Websites	
• http://www.forbes.com/	
Frror! Hyperlink reference not valid	
www.reuters.com/	
• <u>www.cnnmoney.org/</u>	
• www.tinancialtimes.com/	
Useful Journals	
Journal of Finance	
Journal of Financial Economics	
Review of Financial studies	
Global Finance Journal	

• Indian Journal of Finance

## K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109 **DEPARTMENT OF MANAGEMENT STUDIES**

#### **CO-PO Mapping**

#### **Teaching and Learning Methods**

- 1. Lecture class: 44 hrs
- 2. Practical classes: 08 hrs

Ouestion Paper: 40 % Theory 60% problems

#### Assessment

Type of test/examination: Written examination

Continuous Internal Evaluation(CIE): 40 marks (Average of THREE tests will be considered)

Semester End Exam(SEE) : 100 marks (students have to answer all main questions) which will be reduced

to 60 Marks.

Test duration: 1:30 hrs

Examination duration: 3 hrs

PO1: Acquire sufficient theoretical knowledge and are enabled to apply them to solve practical problems in business and other organizations/ institutions of importance.

PO2: Apply effective communication skills with a high degree of lateral and critical thinking that enhances learn ability, developed for being continuously employable.

PO3: Demonstrate leadership qualities, ethically sound, enabled with decision making skills that reflect

a high degree of social consciousness

PO4: Recognize the need for sustained research orientation to comprehend a growing complex, economic, legal and ethical environment

PO5: Possess self- sustaining entrepreneurship qualities that encourages calculated risk taking.

PSO1: Develop viable Managerial solutions in the dynamic Business eco system

PSO2: Establish and Encourage Entrepreneurial zeal along with Ethical Values in the business

СО				PO				
		PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
20MBA22	K- Level	-	-	-	-	-	-	-
CO1	К3	3	-	-	-	-	2	2
CO2	К3	3	3	-	-	-	2	1
CO3	К3	3	3	-	-	-	2	1
CO4	К3	3	-	2	-	-	1	1
CO5	К3	3	-	2	3	-	1	2
CO6	К3	3	-	2	-	-	3	1

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**Course In charge** 

Head of the Department -MBA

Principal Dr. K. RAMA NARASIMHA Principal/Director K S School of Engineering and Management Bengaluru - 560 109

## HOOL OF ENGINEERING AND MANAGEMENT, BENGALURU - 560109 DEPARTMENT OF MECHANICAL ENGINEERING SESSION: 2021-2022 (EVEN SEMESTER)

## **CO-PO MAPPING**

Course	: Mechanic	cal N	<b>Aeasurements and Met</b>	rology					
Type: C	Core			Co	urse Code:18N	1E46B			
			No of He	ours per	week				
Theory Theory Theory					Theory	Total teach	ning hours		
(Lectu	re Class)		(Lecture Class)	(Leo	cture Class)	5	0		
	04		04		04		0		
				Marks	T. to mal				
Interna	l Assessme	ent	Internal Assessme	ent	Assessment	C	redits		
1: 10	40		40		40		4		
1. Tol 2. Tol 3. Tol 4. To	bjective of have a work have a know understand get an idea	the ing k wlec the	<u>Course</u> : mowledge of the different to lge of different types of o effect Errors during mea	measuring compara isuring	g instruments tors				
Course After co	Learning ( ompleting th	Dutc e co	omes urse, the students will be a	ble to					
CO1	O1 Understand the objectives of metrology, methods of measurement, selection of measuring instruments, standards of measurement and calibration of end bars. Describe slip gauges								
CO2	Explain to gauges and	Applying (K3)							
CO3	Describe t	ious method	Applying (K3)						
CO4	CO4 Understand laser interferometers and Coordinate measuring machines. Explain measurement systems, transducers, intermediate modifying devices and terminating devices.								
CO5	Describe measuring	fun g dev	ctioning of force, torq vices	ue, pres	sure, strain an	d temperature	Understandin g (K2)		
			Syll	abus Cor	ntent				
Modu	le-1						C01		
Introd	luction to ]	Met	rology				08 hrs		
Defini	tion, objec	tive	s and concept of metro	ology, N	eed of inspecti	on, Principles.	PO1		
proces	s, method	S 0	t measurement, Classif	fication	and selection	of measuring	PO2		
instrur	nents and s	syste	ms. Accuracy, precision	and erro	ors in measuren	nent.	PO3		
System	n of measu	rem	ent, Material Standard,	Waveler	igth Standards,	Subdivision of	POT		
standa calibra	rds, Line ation of En	and d ba	End standards, Classifirs(Numerical), standardi	ication o ization.	of standards an	d Traceability,	PO12		

Linear Measurement and angular measurements Slip gauges- Indian standards on slip gauge, method of selection of slip gauge, stack of slip gauge, adjustable slip gauge, wringing of slip gauge, care of slip gauge, slip gauge accessories, problems on building of slip gauges (M87, M112). Measurement of angles- sine bar, sine center, angle gauges, optical instruments for angular measurements, Auto collimator-applications for measuring straightness and	
squareness.	
<ol> <li>LO: After competing this unit the student will be able to         <ol> <li>Define the term metrology and list the various objectives of metrology.</li> <li>Explain the principle and the process of measurement.</li> <li>Explain the concept of angle measurement using sine bar, sine center, angle gauges. Also explain the concept of measurement of straightness and squareness using auto-collimator</li> </ol> </li> </ol>	

## Module-2

# System of Limits, Fits, Tolerance and Gauging

Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly, limits of size, Indian standards, concept of limits of size and tolerances, definition of fits, hole basis system, shaft basis system, types of fits and their designation (IS 919-1963), geometric tolerance, position-tolerances.

Classification of an interview of the second	
Wear allowance on an	CO2
gauge limit gauge, Types of gauges-plain plug gauge, ring gauge span	08 hrs
Comparators	PO1
Functional	PO2
comparators did i in internets, classification, mechanical- Johnson Mikrokotor	PO3
comparators, dial indicator, electrical- principles, LVDT. Pneumotic hall	POA
gauges, solex comparators and optical comparators- Zeiss ultra anti-	FU4
LO: After competing this unit the student will be able to	PUS
1. Define the terms tolerance and fit. Also list the work	PO6
their designation, various types of gauges and the set of the set of fits and	PO12
2. Explain limits of size, principle of interval	
assembly, concept of limits of size toleronangeability and selective	
system, geometrical tolerance, positional tol	
1. Explain classification of gauges and way the	
gauge, ring gauge, snap gauge, limit gauge and wear allowances on gauges, plain at	
Module 3: Not gauge and gauge materials	
Measurement of screw thread and gear	
Terminology of screw threads, measurement of	CO3
pitch, angle and effective diameter of screw the	08 hrs
best size wire. Screw thread gauges in the and 3- wire	PO1
terminology, tooth thickness measurement	PO2
comparator method and base tangant method suit constant chord method	PO3
addendum de autoritation, addendum	PO5
pich, concentricity,	PO7

	DO10
run out, and involute profile. Gear roll tester for composite error.	POIZ
Advances in metrology:	
Basic concepts of lasers, advantages of lasers, laser interferometers, types,	Survey and a state
applications. Basic concepts of Coordinate Measuring Machines-constructional	da salah ing
features, applications.	
LO: After competing this unit the student will be able to	
<ol> <li>Explain the terminology of screw threads, measurement of major diameter, minor diameter and pitch angle. Also determine effective diameter of screw threads by 2-wire and 3-wire methods.</li> <li>Evaluate the sensent of heat size wire, tool maker's microscope, and gear</li> </ol>	
tooth terminology	
3 Explain tooth thickness measurement using constant chord method,	
addendum comparator method and base tangent method.	
4. Explain the concept of measurement of pitch, concentricity, run out and involute profile	
Module 4:	승규가 물고 집 같은
Measurement systems and basic concepts of measurement methods: Definition, significance of measurement, generalized measurement system,	
definitions and concept of accuracy, precision, calibration, threshold, sensitivity,	
hysteresis, repeatability, linearity, loading effect, system response-time delay.	
Errors in measurement, classification of errors. Transducers, transfer efficiency,	CO4
primary and secondary transducers, electrical, mechanical, electronic transducers,	08 hrs
advantages of each type transducers.	PO1
Intermediate modifying and terminating devices: Mechanical systems, inherent	PO2
problems, electrical intermediate modifying devices, input circuitry, ballast circuit,	PO3
electronic amplifiers, Terminating devices, Cathode ray oscilloscope,	PO4
Oscillographs.	PO5
LO: After competing this unit the student will be able to	PO12
1. Define the terms accuracy, precision, calibration, threshold, sensitivity,	1012
hysteresis and measurement and also explain the concept of generalized measurement system.	•
2 Define the terms accuracy, precision, calibration, threshold, sensitivity,	
hysteresis, repeatability, linearity, loading effect, system response-times,	
delay time and list the various errors in measurement.	
Module -5:	CO5
IT WILL C.	08 hrs
Force, Torque and Pressure Measurement	PO1
Direct methods and indirect method, force measuring inst. Torque measuring inst.,	PO2
Types of dynamometers, Absorption dynamometer, Prony brake and rope brake	PO3
dynamometer, and power measuring instruments. Pressure measurement, principle,	PO4
use of elastic members, Bridgeman gauge, McLeod gauge, Pirani gauge.	PO5
Measurement of strain and temperature	POG
Theory of strain gauges, types, electrical resistance strain gauge, preparation and	
mounting of strain gauges, gauge factor, methods of strain measurement	·   ·   ·

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PO8: Ethics PO9: Individual & Team Work PO2: Problem Analysis PO10: Communication PO3: Design & Development PO11: Project Mngmt & Finance **PO4:**Investigations of Complex Problems PO12: Life long Learning PO5: Modern Tool Usage PO6: Engineer & Society PSO1: Ability to apply concept of mechanical engineering to design a system, a component or a process/system to address a real world challenges PSO2: Ability to develop effective communication, team work, entrepreneurial and computational skills

со	РО	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PS O1	PS O2	
18 ME46B	K- level															
COI	K3	3	3	3	2	-	1	-	-	-		-	1	3	1	4
CO2	K3	3	3	2	2	-	1	-	-	-	-	-	1	3	1	
CO3	K3	3	3	3	2	1	1	-	-	-	-	-	1	3	1	
CO4	K3	3	3	3	2	1	1	-	-	-	-	-	1	3	1	
CO5	K3	3	3	3	2	1	1		-	-	-	-	1	3	1	

Head

15. Ramar Dr. K. Rama Narasimha Principal/Director KS Scher-Managemen Bengaluru - 560 11

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Course In charge