B.E, IV Semester, Electronics & Communication Engineering

Course Title	PROBABILITY THEORY, COMPLEX VARIABLES AND OPTIMIZATION	Semester	IV
Course Code	MVJ20MEC41	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 2 : 2: 0)	Total	100
Credits	3	Exam. Duration	3Hrs

Course objective is to:

- Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.
- Learn the mathematical formulation of linear programming problem
- Understand the concepts of Complex variables and transformation for solving Engineering Problems.
- Understand the concepts of complex integration, Poles and Residuals in the stability analysis of engineering problems.
- Learn the solutions of partial differential equations numerically.

Module-1	RBT Level L1, L2	8Hrs.

Probability Theory: Random variables (discrete and continuous), probability density function, cumulative density function.

Probability Distributions: Binomial distribution, Poisson distribution. Normal distribution, Exponential distribution, Joint probability distributions.

Applications: Discrete and continuous probability distributions help in analyzing the probability models arising in engineering field.

Video Link:

1. https://youtu.be/cp7_ZF2kNi4

Module-2	RBT Level L1, L2	8Hrs.
Optimization: Linear Programming, mathematical formulation of linear programming problem (LPP), Types of solutions, Graphical Method, simplex method, big-M method, Dual – simplex method. **Applications**: Applications of transport Problems **Video Link**: 1. https://youtu.be/WZIyL6pcItY		
Module-3	**RBT Level L1, L2, L3**	**8Hrs.**
Complex Variables: Functions of complex variables, Analytic function, Cauchy-Riemann equations in Cartesian and polar coordinates, Consequences of Cauchy-Riemann equations, Properties of analytic functions. Application to flow problems- complex potential, velocity potential, equipotential lines, stream functions, stream lines. **Applications**: Application to flow problems **Video Link**: 1. https://youtu.be/b5VUnapu-qs		
Module-4	**RBT Level L1, L2, L3**	**8Hrs.**
Complex line integrals- Cauchy's theorem and Cauchy's integral formula, Singularities, Types of Singularities, Poles, Residues-definitions, Cauchy residue theorem –Problems. Conformal transformation, Bilinear transformation and discussion of $w = z^2$, $w = e^z$ and $w = z + \frac{a^2}{z}(z \neq 0)$. **Applications**: To evaluate line integral of analytic function over closed curve **Video Link**: 1. https://youtu.be/qTDDFMAt7j4		
Module-5	**RBT Level L2, L3**	**8Hrs.**
Numerical solutions of PDE – Classification of second order equations, finite difference		

approximation to derivatives, solution of heat equations, solution of wave equations and solution of Laplace equation.

Applications: To solve boundary value problems

Video Link:

1. https://youtu.be/nNnnBMF03lI

Course Outcomes:	
CO1	Apply discrete and continuous probability distributions in analyzing the probabilit models arising in engineering field.
CO2	Learn the mathematical formulation of linear programming problem
CO3	Use the concepts of analytic function and complex potentials to solve the problem arising in electromagnetic fieldtheory
CO4	Utilize conformal transformation and complex integral arising in aerofoil theory Fluid flow visualization and image processing
CO5	Learn the numerical solutions of partial differentialequations

Text Books:	
1.	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2013.
2.	Prof. G.B.Gururajachar, "Engineering Mathematics –III, Academic Excellent series publications, 2016 – 17.
3.	Prof. G.B.Gururajachar, "Engineering Mathematics –IV, Academic Excellent series publications, 2017 – 18.
Reference Books:	
1.	Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10th edition, 2014.
2.	Ramana B. V., "Higher Engineering Mathematics", Tata Mc Graw-Hill, 2006.
3.	Bali N. P. & Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 8th Edition
4.	H K Dass:"Advanced Engineering Mathematics"- S Chand & Company Ltd. 12th edition.

CIE Assessment:
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests - Quizzes/mini tests (4 marks) - Mini Project / Case Studies (8 Marks) - Activities/Experimentations related to courses (8 Marks)
SEE Assessment:
i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions. iii. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	3	-	-	-	-	-	-	1	1
CO2	3	3	-	3	-	-	-	-	-	-	1	-
CO3	3	2	-	2	-	-	-	-	-	-	-	-
CO4	3	3	-	3	-	-	-	-	-	-	-	1
CO5	3	3	-	3	-	-	-	-	-	-	1	-

High-3, Medium-2, Low-1

Course Title	SIGNALS AND SYSTEMS	Semester	IV
Course Code	MVJ20EC42	CIE	50
Total No. of Contact Hours	50	SEE	50
No. of Contact Hours/week	4 (L : T : P :: 3 : 2 : 0)	Total	100
Credits	4	Exam. Duration	3Hrs

Course objective is to:

- Analyse the mathematical description of continuous and discrete time signals and systems.
- Analyse the signals in time domain using convolution sum and Integral.
- Determine the response of the LTI system to any input signal.
- Analyse Linear Time Invariant (LTI) systems in time and transform domains
- Apply the knowledge of frequency-domain representation and analysis concepts using Fourier analysis tools and Z-transform.

Module-1	RBT Level L1,L2,L3	10Hrs.

Prerequisites: Definition of step, ramp, impulse response

Introduction and Classification of signals: Definition of signal and systems, Communication and control system as examples, Classification of signals.

Basic Operations on signals: Amplitude scaling, addition, multiplication, differentiation, Integration, time scaling, time shift and time reversal.

Elementary signals/Functions: Exponential, sinusoidal, step, impulse and ramp functions. Expression of triangular, rectangular and other waveforms in terms of elementary signals

Laboratory Sessions/ Experimental learning:

1. Exploring concepts with MATLAB- Generation of both continuous time and discrete time signals of various kinds.
    a) Plot $y(x) = x^2\cos(x)$, $g(x) = x\cos(x)$, $f(x) = 2^x\sin(x)$, $0 \leq x \leq 2\pi$ in the same figure.
2. Generation of Signals & Signal Operations

Plot in the time interval $-5 \leq t \leq 10$, the following signals:

a) $\delta(t) + 2\,\delta(t)$

b) u(t) +2 u(t)+1

c) r(t)+u(t)

Applications: Time shifting operation can be used in artificial intelligence, such as in systems that use Time Delay Neural Network, Multiplication of signals is exploited in the field of analog communication when performing amplitude modulation (AM), Differentiation of a signal is used in the field of image or video processing.

Video link / Additional online information :

1. https://nptel.ac.in/courses/108/104/108104100/

Module-2	RBT Level L1,L2,L3	10Hrs.

System Classification and properties: Linear-nonlinear, Time variant-invariant, Causal-non causal, static-dynamic, stable-unstable, invertible.

Time domain representation of LTI System: Impulse response of an LTI system, convolution sum, Convolution integral. Properties of convolution - Commutative property, Distributive property, Associative Property and system interconnection. Computation of convolution sum and convolution integral using graphical method for unit step and unit step, unit step and exponential, exponential and exponential, unit step and rectangular, and rectangular and rectangular.

Laboratory Sessions/ Experimental learning:

1. To compute convolution of two signals using MATLAB.
   a) A system is described by the impulse response h (t) =t, $0 \leq t \leq 10$. Compute and plot the response of the system to the input signal $x(t)=0.8^{t}$, $0 \leq t \leq 10$.
   b) Compute the convolution between the complex sequence =[3+2j,1+j,4+6j] and h=[1-2j,j,3-2j,2].

Applications: Convolution concepts are used in Artificial Intelligence, Image Processing, Signal filtering, Audio processing

Video link / Additional online information :

1. https://nptel.ac.in/courses/117105134/
2. http://www.digimat.in/nptel/courses/video/108108109/L63.html

Module-3	RBT Level L1,L2,L3	10Hrs.

Prerequisites: Basics of Fourier series concepts

LTI system Properties in terms of impulse response: Memoryless, Causal, Stable, Invertible, and step response.

Fourier Representation of Periodic Signals: CTFS and DTFS and basic problems (excluding properties).

Laboratory Sessions/ Experimental learning:

1. To analyse the spectrum of signal with Fourier series using MATLAB.
    a) Verify the linearity property of the given periodic signals x(t)=cos(t) and y(t)=sin(2t),scalars are a=3+2j,b=2.
    b) Verify the time reversal propertyof the given periodic signal x(t)=t cos(t) ,0 ≤ t ≤ 2 Л in one period.

Applications: Signal Processing, Control Theory, Communications Systems, Image and Video Processing, Biomedical Engineering (ECG, MRI), Oil extraction (Seismology), Music Industry (Audio) and Power Quality Analysis.

Video link / Additional online information :

1. https://nptel.ac.in/courses/111106046/
2. https://nptel.ac.in/courses/111106111/

Module-4	RBT Level L1,L2,L3,L4	10Hrs.

Prerequisites: Basics of Fourier transform concepts

Fourier Representation of aperiodic Signals: Introduction to Fourier Transform & DTFT, Definition and basic problems. Properties of Fourier Transform: Linearity, Time shift, Frequency shift, scaling, Differentiation and Integration, Convolution and Modulation, Parseval's theorem and problems on properties of Fourier Transform.

Laboratory Sessions/ Experimental learning:

1. Application of Fourier Transform in Modulation and Demodulation Technology using MATLAB.
    a) Compute the Fourier transform of the function x(t) = e^{-t} u(t)
    b) Suppose that a signal x(t) is given by x(t)=te^{-3t}. Compute the Fourier transform X (w) of the signal of the signal x(t) and plot for -20 ≤ w ≤ 20 rad/sec.

Applications: Fourier Transform in Modulation and Demodulation Technology, Frequency division multiplexing and time division multiplexing, In Filtering Technology

Video link / Additional online information : 1. https://nptel.ac.in/courses/111102129/ 2. https://nptel.ac.in/courses/111106046/		
Module-5	**RBT Level L1,L2,L3**	**10Hrs.**

Prerequisites: Basics of Z-transform concepts

The Z-Transforms: Z transform, properties of the region of convergence, properties of the Z-transform, Inverse Z-transform, Causality and stability, Transform analysis of LTI systems.

Laboratory Sessions/ Experimental learning:

1. To compute Z-transform of finite duration sequence using MATLAB.
   a) Compute the z-transform of the sequence fx(n)-[-3,5,6,7,8], $-2 \leq n \leq 2$.
   b) Compute the z-transform of the discrete-time signal $x(n)= n^2 u(n)$.
   c) Compute the convolution between the signals $X_1(z)=$ z/z-0.9 and $X_2(z)=$z /z+6

Applications: To analysis of digital filters, Used to simulate the continuous systems, Analyse the linear discrete system, Used to finding frequency response, Analysis of discrete signal, Helps in system design and analysis and also checks the systems stability, For automatic controls in telecommunication.

Video link / Additional online information:

1. https://nptel.ac.in/courses/108104100/

Course outcomes:	
CO1	Analyze the different types of signals and systems.
CO2	Develop input output relationship for linear time invariant system and understand the convolution operator for continuous and discrete time system.
CO3	Understand and resolve the signals in frequency domain using Fourier series.
CO4	Determine the spectral characteristics of continuous and discrete time signal using Fourier transform.
CO5	Compute Z-transforms, inverse Z- transforms and transfer functions of complex LTI systems

Text Books:	
1.	Simon Haykins and Barry Van Veen,"Signals and Systems", 2nd Edition, 2008, Wiley India. ISBN 9971-51-239-4.
2.	Ganesh Rao and SatishTunga, "Signals and Systems", Pearson/Sanguine, Edition,2017.
Reference Books:	
1.	Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab,"Signals and Systems" Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint 2002.
2.	Michael Roberts, "Fundamentals of Signals & Systems", 2nd edition, Tata McGraw-Hill, 2010, ISBN 978-0-07-070221-9.
3.	H.P Hsu, R. Ranjan, "Signals and Systems", Scham's outlines, TMH, 2006.
4.	B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2005.

CIE Assessment:
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CO-PO Mapping												
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CO2	3	3	2	3	3	-	-	-	-	-	3	2
CO3	3	3	2	3	3	-	-	-	-	-	3	1
CO4	3	3	2	2	3	-	-	-	-	-	3	1
CO5	3	2	2	3	2	-	-	-	-	-	3	2

High-3, Medium-2, Low-1

Course Title	CONTROL SYSTEM	Semester	IV
Course Code	MVJ20EC43	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3Hrs

Course objective is to:

- Formulate the mathematical modelling of systems and understand the concepts of transfer function,
- Obtain transfer function using block diagram reduction and signal flow graph techniques.
- Analyse the response of first and second order systems using standard test signals and analyse steady state error.
- Analyse stability of systems using RH criteria, Root Locus, Nyquist, Bode plot and polar plot.
- Obtain state variable model for electrical systems.

Module-1	RBT Level L1, L2, L3	8Hrs.

Introduction to Control Systems: open loop and closed loop systems, Types of feedback, Differential equation of Physical Systems – Mechanical Systems, Electrical Systems, Analogous Systems.

Block diagrams and signal flow graphs: Transfer functions, Block diagram algebra and Signal Flow graphs.

Laboratory Sessions/ Experimental learning:

1. Determine and plot poles and zeros from the transfer function using MATLAB.

Applications: Electric Hand Drier, Automatic Washing Machine, DC motor,Automatic Electric Iron, Voltage Stabilizer

Video link / Additional online information :

1. https://youtu.be/R0E3uKSKdME
2. https://youtu.be/zXMklO-jxIo

3. https://youtu.be/tDXgiStzbcY

Module-2	RBT Level L1, L2, L3	8Hrs.

Time Response of feedback control systems: Standard test signals, Unit step response of First and Second order Systems. Time response specifications, Time response specifications of second order systems, steady state errors and error constants. Introduction to Controllers

Laboratory Sessions/ Experimental learning:

1. Obtain step and impulse response of a unity feedback first order system for a given forward path transfer function using MATLAB.
2. Obtain step and impulse response of a unity feedback second order system for a given forward path transfer function using MATLAB.

Applications: Industrial Control systems

Video link / Additional online information :

1. https://youtu.be/ziu1OTwUrbw
2. https://youtu.be/YuZ3iwA-47I

Module-3	RBT Level L1, L2, L3,L4	8Hrs.

Stability analysis using RH Criteria and root locus: Concepts of stability, Necessary conditions for stability, Routh Hurwitz stability criterion, Relative stability analysis, Introduction to Root-Locus Techniques, the root locus concepts, Construction of root loci.

Laboratory Sessions/ Experimental learning:

1. Obtain Root Locus Plot of the system for a given forward path transfer function using MATLAB.

Applications: Used to determine the dynamic response of a s system

Video link / Additional online information:

1. https://youtu.be/cez4InLZ7Pw
2. https://youtu.be/sUDoTw_LIbk
3. https://youtu.be/Irxppc_LCUk

Module-4	RBT Level L1, L2, L3, L4	8Hrs.

Stability analysis using Nyquist criteria and Bode plots: Polar plot, Nyquist Stability criterion, Nyquist plots, Bode plots, Gain and phase margin.

Laboratory Sessions/ Experimental learning:

1. Obtain Bode Plot of the system for a given forward path transfer function using MATLAB.
2. Obtain Nyquist Plot of the system for a given forward path transfer function using MATLAB.

Applications: To determine a stability of a system

Video link / Additional online information:

1. https://youtu.be/QzTCRk4nkDg
2. https://youtu.be/Wi6xt7IyjA0

Module-5	RBT Level L1, L2, L3	8Hrs.

Introduction to State variable analysis: Concepts of state, state variable and state models for electrical systems, Solution of state equations, State transition matrix and its properties.

Laboratory Sessions/ Experimental learning:

1. Determining the solution of state equations using MATLAB.

Applications: State variables are used to describe the future response of a dynamic response

Video link / Additional online information:

1. https://youtu.be/xajgSUci9zs

Course outcomes:	
CO1	Write the mathematical model for electrical systems and find the transfer function using block diagram reduction technique and signal flow graph.
CO2	Analyze transient and steady state response of second order systems using standard test signals and analyze steady state error.

CO3	Analyze the stability of the systems by applying RH criteria and root locus techniques.
CO4	Analyze the stability of the system using frequency domain techniques such as Nyquist and Bode plots.
CO5	Write state space equations and solutions of a given electrical system.

Text Books:	
1.	Modern Control Engineering, K.Ogata, Pearson Education Asia/PHI, 4th Edition, 2002. ISBN 978-81-203-4010-7.
2.	Nagarath and M.Gopal, – Control Systems Engineering‖, New Age International (P) Limited, Publishers, Fifth edition-2005, ISBN: 81-224-2008-
Reference Books:	
1.	Automatic Control Systems‖, Benjamin C. Kuo, John Wiley India Pvt. Ltd., 8th Edition, 2008.

CIE Assessment:

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- Quizzes/mini tests (4 marks)
- Mini Project / Case Studies (8 Marks)
- Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours.

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CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	-	-	-	-	-	-	-	-
CO2	3	2	2	1	-	-	-	-	-	-	-	-
CO3	3	2	2	2	-	-	-	-	-	-	-	-
CO4	3	2	2	2	-	-	-	-	-	-	-	-
CO5	3	2	2	1	-	-	-	-	-	-	-	-

High-3, Medium-2, Low-1

Course Title	LINEAR INTEGRATED CIRCUITS	Semester	IV
Course Code	MVJ20EC44	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3Hrs

Course objective is to:

- Define the basic concepts of OP-Amp, various parameters of Op-Amp, its characteristics and specifications.
- Analyse Op-Amp circuits to determine Input Impedances, output Impedances and other performance parameters.
- Sketch and Explain typical Frequency Response graphs for each of the Filter circuits.
- Describe and Sketch the various switching circuits of Op-Amps and analyse its operations.
- Differentiate between various types of DACs and ADCs and evaluate the performance of each with neat circuit diagrams.

Module-1	RBT Level L1,L2,L3,L4	8Hrs.

Operational Amplifier Fundamentals: Basic Op-amp circuit, Op-Amp parameters – Input and output voltage, CMRR and PSRR, offset voltages and currents, Input and output impedance, Slew rate and Frequency limitations. OP-Amps as DC Amplifiers – Biasing OP-amps, Direct coupled voltage followers, Non-inverting amplifiers, inverting amplifiers, Summing amplifiers, and Difference amplifiers.

Laboratory Sessions/ Experimental learning:

1. To obtain the Gain of inverting & non inverting amplifier by varying the resistor values.

Applications: Sensors, Mixers.

Video link / Additional online information:

1. https://www.youtube.com/watch?v=clTA0pONnMs

Module-2	RBT Level L1,L2,L3,L4	8Hrs.
Op-Amps as AC Amplifiers: Capacitor coupled voltage follower, High input impedance – Capacitor coupled voltage follower, Capacitor coupled non inverting amplifiers, High input impedance – Capacitor coupled Non-inverting amplifiers, Capacitor coupled inverting amplifiers, setting the upper cut-off frequency, Capacitor coupled difference amplifier. OP-Amp Applications: Current amplifiers, instrumentation amplifier, Precision Half wave rectifiers, Precision Full wave rectifiers - Half wave rectifier & Summing Amplifier. **Laboratory Sessions/ Experimental learning:** 1. Design and find the gain of a Differential Amplifier. **Applications:** Industrial areas (Temperature Indicator, Light Intensity Meter, Temperature Controller) **Video link / Additional online information:** 1. https://www.youtube.com/watch?v=GjG8oshYNLQ		
Module-3	**RBT Level L1,L2,L3,L4**	**8Hrs.**
Op-amp Applications: Limiting circuits - Peak Clipper, Clamping circuits, Precision Rectifier Peak Detectors, Sample and hold circuits, Differentiating Circuit, Integrator Circuit, Phase shift oscillator, Wein bridge oscillator, Zero Crossing detectors, inverting Schmitt trigger, Log and antilog amplifiers, Multiplier, and divider. **Laboratory Sessions/ Experimental learning:** 1. Design and verify a sample and hold circuit using IC 741 opamp. **Applications:** Quartz watches, various radio, TV, and other communication devices, alarms and buzzes. **Video link / Additional online information:** 1. https://www.youtube.com/watch?v=xki9taCqsWY		
Module-4	**RBT Level L1,L2,L3,L4**	**8Hrs.**
Active Filters: First order and second order active Low-pass and high pass filters, Bandpass Filter, Band stop Filter.Voltage Regulators: Introduction, Series Op-amp		

regulator, IC voltage regulators, Voltage follower regulator, 723 general purpose regulators - Introduction, Low Voltage Regulator, High Voltage Regulator. **Laboratory Sessions/ Experimental learning:** 1. Design & setup a low voltage regulator for an output voltage of 6V using 723 IC. **Applications:** Communication systems, Audio systems and Biomedical instruments **Video link / Additional online information:** 1. https://www.youtube.com/watch?v=y5s4bQnmV-g

Module-5	RBT Level L1,L2,L3,L4	8Hrs.
Phase locked loop: Basic Principles, Phase detector/comparator, VCO. **DAC and ADC convertor:** DAC using R-2R, ADC using Successive approximation. **Other IC Application:** 555 timer, Basic timer circuit, 555 timer used as astable and monostable multivibratos. **Specialized IC Applications:** Introduction on Universal active filters, Power amplifiers-LM380 Power Audio amplifier. **Laboratory Sessions/ Experimental learning:** 1. Demonstrate a simple light circuit that uses a decade counter to drive two traffic lights and uses 555 timer chip as clock. **Applications:** PWM (Pulse Width Modulation) & PPM (Pulse Position Modulation), Analog frequency meters, Digital logic probes. **Video link / Additional online information:** 1. https://www.youtube.com/watch?v=-KMAQxc3J3g		

Course outcomes:	
CO1	Acquire knowledge about fundamental concepts of Op-Amp circuit and parameters.
CO2	Describe AC Amplifiers and application.
CO3	Develop circuits for Op-Amp based linear and non-linear circuits.
CO4	Acquire knowledge about Active Filters and Voltage Regulators.
CO5	Explain applications of linear ICs in phase detector, VCO, DAC, ADC and Timer.

Text Books:	
1.	"Operational Amplifiers and Linear IC"s", David A. Bell, 2nd edition, PHI/Pearson, 2004. ISBN 978-81-203-2359-9.
2.	"Linear Integrated Circuits", D. Roy Choudhury and Shail B. Jain, 4th edition, Reprint 2006, New Age International ISBN 978-81-224-3098-1.
Reference Books:	
1.	Ramakant A Gayakwad, "Op-Amps and Linear Integrated Circuits," Pearson, 4th Ed, 2015. ISBN 81-7808-501-1.

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- Quizzes/mini tests (4 marks)
- Mini Project / Case Studies (8 Marks)
- Activities/Experimentations related to courses (8 Marks)

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iii. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

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CO3	3	2	3	2	2	-	1	-	-	-	1	1
CO4	3	3	2	2	3	-	1	-	-	-	1	1
CO5	3	3	3	2	3	-	1	-	-	-	1	1

High-3, Medium-2, Low-1

Course Title	ELECTRONIC INSTRUMENTATION	Semester	IV
Course Code	MVJ20EC45	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3Hrs

Course objective is to:

- Define and describe accuracy and precision, types of errors.
- Describe the operation of Ammeters, Voltmeters, Multimeters and develop circuits for multirange Ammeters and Voltmeters.
- Describe functional concepts and operation of various Analog and Digital measuring instruments.
- Describe basic concepts and operation of Digital Voltmeters.
- Describe and discuss functioning and types of Oscilloscopes, Signal generators, AC and DC bridges, Transducers.

Module-1	RBT Level L1,L2,L3,L4	8Hrs.

Measurement and Error: Definitions, Accuracy, Precision, Resolution and Significant Figures, Types of Errors, Measurement error combinations.

Ammeters: DC Ammeter, Multirange Ammeter, The Ayrton Shunt or Universal Shunt, Requirements of Shunt, Extending of Ammeter Ranges, RF Ammeter (Thermocouple), Limitations of Thermocouple.

Voltmeters and Multimeters: Introduction, Basic Meter as a DC Voltmeter, DC Voltmeter, Multirange Voltmeter, Extending Voltmeter Ranges, Loading, AC Voltmeter using Rectifiers. True RMS Voltmeter, Multimeter.

Laboratory Sessions/ Experimental learning:

1. Understanding the structure of the ammeter, voltmeter, and ohmmeter. Learning how to use those meters and using them to measure the current, voltage, and resistance of an electric circuit.
2. Calibration of Voltmeters and Ammeters using Potentiometers.

Applications: Measuring Devices. Ammeters and Voltmeters are used as measuring devices in Laboratory for the measurement of current and voltage.

Video link / Additional online information:

1. https://nptel.ac.in/courses/108/105/108105153/
2. https://www.digimat.in/nptel/courses/video/108105153/L13.html
3. https://www.digimat.in/nptel/courses/video/108105153/L14.html
4. https://www.digimat.in/nptel/courses/video/108105153/L15.html

Module-2	RBT Level L1,L2,L3	8Hrs.

Digital Voltmeters: Introduction, RAMP technique, Dual Slope Integrating Type DVM, Integrating Type DVM, Most Commonly used principles of ADC, Successive Approximations, -Digit, Resolution and Sensitivity of Digital Meters, General Specifications of DVM

Digital Instruments: Introduction, Digital Multimeters, Digital Frequency Meter, Digital Measurement of Time, Universal Counter, Digital Tachometer, Digital pH Meter, Digital Phase Meter, Digital Capacitance Meter.

Laboratory Sessions/ Experimental learning:

1. Demonstrate how an universal counter can be used for measuring time, frequency, pulse rates, pulse counting, periodic times, speeds and velocities.

Applications: Automatic Measurements. Digital Instruments provide greater speed, increased accuracy, better resolution, reduction in operator errors and the ability to provide automatic measurements in system application.

Video link / Additional online information :

1. https://www.digimat.in/nptel/courses/video/108105153/L64.html
2. https://www.digimat.in/nptel/courses/video/108105153/L65.html

Module-3	RBT Level L1,L2,L3	8Hrs.

Oscilloscopes: Introduction, Basic principles, CRT features, Block diagram of Oscilloscope, Simple CRO, Vertical Amplifier, Horizontal Deflecting System, Sweep or Time Base Generator, Measurement of Frequency by Lissajous Method, Digital Storage Oscilloscope.

Signal Generators: Introduction, Fixed and Variable AF Oscillator, Standard Signal Generator, Laboratory Type Signal Generator, AF sine and Square Wave Generator, Function Generator.

Laboratory Sessions/ Experimental learning:

1. Testing of Energy meters

Applications: Laboratory Equipment. An oscilloscope can help the user get more detailed electrical measurements.A signal generator is usedto produce various patterns of voltage at a variety of frequencies and amplitudes.

Video link / Additional online information:

1. https://nptel.ac.in/courses/115/105/115105121/
2. https://nptel.ac.in/courses/108/105/108105153/

Module-4	RBT Level L1,L2,L3	8Hrs.

Measuring Instruments: Field Strength Meter, Stroboscope, Phase Meter, Q Meter, Megger.

Bridges: Introduction, Wheatstone's bridge, Kelvin's Bridge; AC bridges, Capacitance Comparison Bridge, Inductance Comparison Bridge, Maxwell's bridge, Wien's bridge.

Laboratory Sessions/ Experimental learning:

1. Measurement of Low Resistance by Kelvin's Double Bridge Method.
2. Measurement of Resistance using Wheatstone's bridge.

Applications: Measurement and control. Measuring instruments are used for Control of processes and operations. Bridge circuits are used in measurement, filtering and power conversion applications.

Video link / Additional online information:

1. https://www.youtube.com/watch?v=rQPemWEWNYg

Module-5	RBT Level L1,L2,L3	8Hrs.

Transducers: Introduction, Electrical transducers, Selecting a transducer, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive transducer, LVDT, Piezoelectric transducer, Photo cell, Photo voltaic cell, Semiconductor photo diode and transistor.

Laboratory Sessions/ Experimental learning:

1. Characteristics of RTD,Strain gauges,Photocell,LVDT

Applications: Automation and control.Transducers are used at the boundaries of automation, measurement, and control systems, where electrical signals are converted to and from other physical quantities.

Video link / Additional online information:

1. https://www.youtube.com/watch?v=1uPTyjxZzyo
2. https://www.youtube.com/watch?v=nv3GuJArjNU
3. https://www.youtube.com/watch?v=f6miNLVGTqU

Course outcomes:	
CO1	Describe instrument measurement errors and calculate them.
CO2	Describe the operation of Ammeters, Voltmeters, Multimeters and develop circuits for multirange Ammeters and Voltmeters.
CO3	Describe functional concepts and operation of Digital voltmeters and instruments to measure voltage, frequency, time period, phase difference of signals, rotation speed, capacitance and pH of solutions.
CO4	Describe functional concepts and operation of various Analog measuring instruments to measure field Strength, impedance, stroboscopic speed, in/out of phase, Q of coils, insulation resistance.
CO5	Describe and discuss functioning and types of Oscilloscopes, Signal generators and Transducers.

Text Books:	
1.	H. S. Kalsi, "Electronic Instrumentation", McGraw Hill, 3 rd Edition, 2012, ISBN: 9780070702066.
2.	David A. Bell, "Electronic Instrumentation & Measurements", Oxford University Press PHI 2nd Edition, 2006, ISBN 81-203-2360-2.
Reference Books:	
1.	A. K. Sawhney, –Electronics and Electrical Measurements‖, DhanpatRai& Sons. ISBN -81-7700-016-0

2.	A. D. Helfrick and W.D. Cooper, "Modern Electronic Instrumentation and Measuring Techniques", Pearson, 1st Edition, 2015, ISBN: 9789332556065.

CIE Assessment:
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests - Quizzes/mini tests (4 marks) - Mini Project / Case Studies (8 Marks) - Activities/Experimentations related to courses (8 Marks)
SEE Assessment:
i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions. iii. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	1	-	1	-	-	1
CO2	3	3	3	3	3	2	1	-	1	-	-	1
CO3	3	3	3	2	3	2	1	-	1	-	-	1
CO4	3	3	2	2	3	2	1	-	1	-	-	1
CO5	3	3	3	2	3	2	1	-	1	-	-	1

High-3, Medium-2, Low-1

Course Title	PYTHON FOUNDATION FOR ELECTRONICS ENGINEERING	Semester	IV
Course Code	MVJ20EC46	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 3 : 0 : 0)	Total	100
Credits	3	Exam. Duration	3Hrs

Course objective is to:

- To know the basics of Python Programming and to read and write simple Python programs with expression and statements.
- To develop Python programs with conditionals and loops.
- To define Python functions and call the function.
- To implement Python Programming in Arduino.
- To Understand the Python programming for Data Science.

Module-1	RBT Level L1, L2,L3	8Hrs.

Prerequisite: Basic mathematical calculation skills and logical skills

The Context of Software Development: Software, Development Tools, Learning Programming with Python, The Python Interactive Shell. Values and Variables, Integer and String Values, Variables and Assignment, Identifiers, Floating-point Numbers, Control Codes within Strings, User Input , Controlling the print , String , Multi-line Strings Writing a Python Program and a Longer Python program.

Laboratory Sessions/ Experimental learning:

1. Print "Python foundation for Electronics Engineering "by executing python programming.

Applications: Printing of Results from the modules.

Video link / Additional online information:

1. https://pythonprogramming.net › introduction-learn-python-3-tutorials

Module-2	RBT Level L1, L2,L3	8Hrs.

Expressions and Arithmetic: Expressions; Mixed Type Expressions; Operator Precedence and Associativity; Formatting Expressions; Errors ; Syntax Errors; Run-time Exceptions ; Logic Errors ; Arithmetic Operators;

Conditional Execution: Boolean Expressions, Statements, Compound Boolean Expressions, Floating-point Equality, Nested Conditionals, Multi-way Versus Sequential Conditionals, Conditional Expressions, Errors, Logic Complexity

Laboratory Sessions/ Experimental learning:

1. Find the Greatest Number among "12345, 32145 and 23154" by executing python programming.

Applications: Arithmetic / Conditional Operations

Video link / Additional online information:

1. https://www.coursera.org/lecture/interactive-python-1/arithmetic-expressions-rMvoA

Module-3	RBT Level L1,,L2, L3	8Hrs.

Iterations And Functions; Iteration: While Statement; Definite Loops vs Indefinite Loops; for Statement; Nested Loops; Abnormal Loop Termination; while/else and for/else; Infinite.

Functions: Introduction to Using Functions ; Functions and Modules ; Function Basics ; Types of Functions; Parameter Passing ; Documenting Functions and Custom Functions vs. Standard Functions Turtle Graphics ; Techniques for Importing Functions and Modules; Writing Functions.

Laboratory Sessions/ Experimental learning:

1. Compute Square Root, Drawing a Tree, Printing Prime Numbers and Insisting on Proper Input by using Iterations.

Applications: Iterative operations can be implemented

Video link / Additional online information:

1. https://www.codementor.io/@kaushikpal/user-defined-functions-in-python-8s7wyc8k2

Module-4	RBT Level L1,L2, L3	8Hrs.

Lists, Tuples, Dictionaries; Lists: list operations, slices, methods and parameters; **Tuples:** tuple assignment, tuple as return value; **Dictionaries:** operations and methods.

Arduino with Python: Introduction to Arduino programming History; Why Arduino; Arduino variants; Comments; Variables; Constants; Data types; Conversions; Functions and statements; setup function; loop function; pin Mode function; Working with pins; Statements

Laboratory Sessions/ Experimental learning:

1. How to apply the Firmata Protocol and to connect the Arduino board for python programming execution.

Applications: Implementation of modules in Aurdino board

Video link / Additional online information :

1. https://www.electronicshub.org/arduino-rf-transmitter-receiver-module/

Module-5	RBT Level L4, L5	8Hrs.

Data Science and Python: Considering the emergence of data science; Outlining the core competencies of a data scientist ; Linking data science and big data ;Understanding the role of programming ; Creating the Data Science Pipeline ; Understanding Python's Role in Data Science; Considering the shifting profile of data scientists; Working with a multipurpose, simple, and efficient language; Learning to Use Python Fast.

Laboratory Sessions/ Experimental learning:

1. How to Load, Train and View a simple model using python programming.

Applications: Machine Learning Project in Python

Video link / Additional online information:

1. https://data-flair.training/blogs/train-test-set-in-python-ml/

Course outcomes:	
CO1	Understand the Basics of Python Programming
CO2	Implement the expression, conditional executions in Python flow.
CO3	Understand the iterations and functions in Python Programming.

CO4	Implement the Python Programming in Arduino.
CO5	Demonstrate python proficiency in handling Data Science.

Text Books:	
1.	Fundamentals of Python Programming, Richard L. Halterman, Southern Adventist University, Year: 2019
2.	Python Programming for Arduino, Pratik Desai ,Packt Publishing Ltd, 2015.
3.	Python for Data Science by Luca Massaron and John Paul MuellerPublished by: John Wiley & Sons, Inc., 2015.
Reference Books:	
1.	Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think- python/)

CIE Assessment:
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests - Quizzes/mini tests (4 marks) - Mini Project / Case Studies (8 Marks) - Activities/Experimentations related to courses (8 Marks)
SEE Assessment:
i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions. iii. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	-	-	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	-
CO3	3	3	2	1	-	-	-	-	-	-	-	-
CO4	3	3	2	1	-	-	-	-	-	-	-	-
CO5	3	3	1	1	-	-	-	-	-	-	-	-

High-3, Medium-2, Low-1

Course Title	LINEAR INTEGRATED CIRCUITS LAB	Semester	IV
Course Code	MVJ20ECL47	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 0 : 2 : 2)	Total	100
Credits	2	Exam. Duration	3Hrs

Course objective is to:

- Design, Demonstrate and Analyse instrumentation amplifier, filters, DAC, adder, differentiator and integrator circuits, using op-amp.
- Design, demonstrate and Analyse multivibrators and oscillator circuits using Op-amp.
- Familiarize with EDA /PSPSICE software which can be used for electronic circuit Simulation.

Laboratory Sessions

Sl No	Experiment Name	RBT Level	Hours
Hardware Experiments			
1	Design Adder, Integrator and Differentiator using Op-Amp.	L3	3
2	Design an instrumentation amplifier of a differential mode gain of "A" using three Amplifiers.	L3	3
3	Test a comparator circuit and design a Schmitt trigger for the given UTP and LTP values and obtain the hysteresis	L3	3
4	Design of RC Phase shift and Wien's bridge oscillators using Op-amp.	L4	3
5	To set up and study a triangular waveform generator using Op-amp for 1kHz frequency	L3	2
6	Design active second order Butterworth low pass and high pass filters	L3	3

7	Design 4-bit R – 2R Op-Amp Digital to Analog Converter (i) using 4 bit binary input from toggle switches and (ii) by generating digital inputs using mod-16 counter.	L4	3
8	Design of Monostable and Astable Multivibrator using 555 Timer.	L3	2
Simulation using EDA software (EDWinXP, PSpice, MultiSim, Proteus, CircuitLab or any other equivalent tool can be used)			
9	RC Phase shift oscillator using Op-amp	L3	2
10	Band-pass Filter and Narrow band-reject filter using Op-amp	L3	2
11	Relaxation oscillator using using Op-Amp.	L3	2
12	Monostable and Astable Multivibrator using 555 Timer	L3	2

Course outcomes:	
CO1	Gain hands-on experience in building analog systems for a given specification using the basic building blocks.
CO2	Design and analyse the performance of instrumentation amplifier and Schmitt Trigger.
CO3	Design and analyse the performance of LPF, HPF, DAC and oscillators using linear IC.
CO4	Analyse the working of 555 timer operations to generate signals/pulses.
CO5	Simulate and analyse electronic circuits for different applications.

Scheme of Evaluation	
Regular Lab work and Writing Lab records	(20+15) = 35 marks
Lab test and Viva-voce at the end of the semester	(10+5) = 15 marks
Total	**50 marks**

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	-	-	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	-
CO3	3	3	2	1	-	-	-	-	-	-	-	-
CO4	3	3	2	1	-	-	-	-	-	-	-	-
CO5	3	3	1	1	-	-	-	-	-	-	-	-

High-3, Medium-2, Low-1

Course Title	PYTHON PROGRAMMING LAB	Semester	IV
Course Code	MVJ20ECL48	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/week	3 (L : T : P :: 0 : 2 : 2)	Total	100
Credits	2	Exam. Duration	3Hrs

Course objective is to:

- Interpret the use of procedural statements like assignments, conditional statements, loops and function calls.
- Infer the supported data structures like lists, dictionaries and tuples in Python.
- Illustrate the application of matrices and regular expressions in building the Python programs.
- Discover the use of external modules in creating excel files and navigating the file systems.
- Describe the need for Object-oriented programming concepts in Python.

Laboratory Sessions

Sl No	Experiment Name	RBT Level	Hours
1	Print all the Disarium numbers between 1 and 100.	L3	3
2	Encrypt the text using Caesar Cipher technique. Display the encrypted text. Prompt the user for input and the shift pattern.	L3	3
3	Perform Jump Search for a given key and report success or failure. Prompt the user to enter the key and a list of numbers.	L3	3
4	The celebrity problem is the problem of finding the celebrity among n people. A celebrity is someone who does not know anyone (including themselves) but is known by everyone. Write a Python program to solve the celebrity problem.	L3	3

5	Construct a linked list. Prompt the user for input. Remove any duplicate numbers from the linked list.	L3	3
6	Traverse a path and display all the files and subdirectories in each level till the deepest level for a given path. Also, display the total number of files and subdirectories	L3	4
7	How to create a menu drive with a dictionary for words and their meanings. How to add the Write functions to add a new entry (word: meaning), search for a particular word and retrieve meaning, given meaning find words with the same meaning, remove an entry, display all words sorted alphabetically.	L5	4
8	Identify a word with a sequence of one upper case letter followed by lower case letters.	L5	3
9	Plot the Line chart in MS Excel Sheet using Xlsx Writer module to display the annual net income of the companies.	L4	4

Course outcomes:	
CO1	Describe the Python language syntax including control statements, loops and functions to write programs for a wide variety problem in mathematics and science.
CO2	Examine the core data structures like lists, dictionaries, tuples and sets in Python to store, process and sort the data.
CO3	Interpret the concepts of Object-oriented programming as used in Python using encapsulation, polymorphism and inheritance.
CO4	Discover the capabilities of Python regular expression for data verification and utilize matrices for building performance efficient Python programs.
CO5	Identify the external modules for creating and writing data to excel files and inspect the file operations to navigate the file systems.

Scheme of Evaluation	
Regular Lab work and Writing Lab records	(20+15) = 35 marks
Lab test and Viva-voce at the end of the semester	(10+5) = 15 marks
Total	50 marks

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	-	-	-	-	-	-	-
CO2	3	2	2	3	3	-	-	-	-	-	-	-
CO3	3	3	3	2	3	-	-	-	-	-	-	-
CO4	2	1	2	2	3	-	-	-	-	-	-	-
CO5	2	1	2	1	3	-	-	-	-	-	-	-

High-3, Medium-2, Low-1

Course Title	ADDITIONAL MATHEMATICS-II (COMMON TO ALL BRANCHES)	Semester	IV
Course Code	MVJ20MATDIP41	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3 (L: T: P: 2 : 2 :0)	Total	100
Credits	-	Exam. Duration	3 Hours

Course objective is to: This course viz., aims to prepare the students:

- To familiarize the important and basic concepts of Differential calculus and Differential Equation, ordinary/partial differential equations and Vector calculus and analyse the engineering problems.

Module-1	RBT Level L1,L2	8Hrs.

Linear Algebra:

Introduction, Rank of a matrix-echelon form. Solution of system of linear equations – consistency. Gauss-elimination method and problems. Eigen values and Eigen vectors of square matrix and Problems.

Video Link:

1. https://www.math.ust.hk/~machas/matrix-algebra-for-engineers.pdf
2. https://nptel.ac.in/content/storage2/courses/122104018/node18.html

Module-2	RBT Level L1,L2	8 Hrs.

Differential calculus:

Tangent and normal, sub tangent and subnormal both Cartesian and polar forms. Increasing and decreasing functions, Maxima and Minima for a function of one variable. Point of inflections and Problems

Beta and Gamma functions:

Beta functions, Properties of Beta function and Gamma function ,Relation Between beta and Gamma function-simple problems.

Video Link:

1. https://www.youtube.com/watch?v=6RwOoPN2zqE
2. https://www.youtube.com/watch?v=s6F5yjY6jWk&list=PLMLsjhQWWlUqBoTCQDtYlloI-o-9hxp11
3. http://tutorial.math.lamar.edu/Classes/DE/IntroPDE.aspx

Module-3	RBT Level L1,L2	8Hrs.

Analytical solid geometry :

Introduction –Directional cosine and Directional ratio of a line, Equation of line in space-different forms, Angle between two line, shortest distance between two line, plane and equation of plane in different forms and problems.

Video Link:

1. https://www.toppr.com/guides/maths/three-dimensional-geometry/
2. https://www.toppr.com/guides/maths/three-dimensional-geometry/distance-between-skew-lines/

Module-4	RBT Level L1,L2,L3	8 Hrs.

Probability:

Random variable, Discrete probability distribution, Mean and variance of Random Variable, Theoretical distribution- Binomial distribution, Mean and variance Binomial distribution - Problems. Poisson distribution as a limiting case of Binomial distribution, Mean and variance of Poisson distribution. Normal Distribution-Basic properties of Normal distribution – standard form of normal distribution and Problems.

Video Link:

1. https://nptel.ac.in/courses/111/105/111105041/
2. https://www.mathsisfun.com/data/probability.html

Module-5	RBT Level L1,L2,L3	8 Hrs.

Partial differential equation: Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivative with respect to one independent variable only.

Video Link:	
1. http://tutorial.math.lamar.edu/Classes/DE/IntroPDE.aspx 2. https://www.studyyaar.com/index.php/module-video/watch/233-cauchys-legendres-de-a-method-of- variation-of-parameters	
Course outcomes:	
CO1	Apply the knowledge of Matrices to solve the system of linear equations and to understand the concepts of Eigen value and Eigen vectors for engineering problems.
CO2	Demonstrate various physical models ,find Maxima and Minima for a function of one variable., Point of inflections and Problems .Understand Beta and Gamma function
CO3	Understand the 3-Dimentional geometry basic, Equation of line in space- different forms, Angle between two line and studying the shortest distance .
CO4	Concepts OF Probability related to engineering applications.
CO5	Construct a variety of partial differential equations and solution by exact methods.

Text Books:	
1	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2013.
2	Ramana B. V., "Higher Engineering Mathematics", Tata Mc Graw-Hill, 2006.
Reference Books:	
1	Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10th edition,2014.
2	G. B. Gururajachar: Calculus and Linear Algebra, Academic Excellent Series Publication, 2018-19

CIE Assessment:
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests - Quizzes/mini tests (4 marks) - Mini Project / Case Studies (8 Marks) - Activities/Experimentations related to courses (8 Marks)

SEE Assessment:
i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions. iii. One question must be set from each unit. The duration of examination is 3 hours.

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CO3	3	3	0	3	0	0	0	0	0	0	0	1
CO4	2	2	0	3	0	0	0	0	0	0	1	1
CO5	2	2	0	2	0	0	0	0	0	0	0	1

High-3, Medium-2, Low-1