Shri Vaishnav Vidyapeeth Vishwavidyalaya

Bachelor of Technology (Railway Engineering)

SEMESTER IV (w.e.f. Batch 2018-19)

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTEE 303		ANALOG ELECTRONICS	2	1	2	4	60	20	20	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

Any electronic trade has its basis on a certain number of components and some basic standard circuits. These common circuits are applied in all sections of the Electronics technology. To learn the basic methods for the design of digital circuits and provide the fundamental Concepts used in the design of digital systems. To introduce basic postulates of Boolean algebra and shows the correlation between.

Course Outcomes:

After the successful completion of this course students will be able to

1. Understand the basic physics of carrier transport in bulk semiconductors and real device structures.
2. Understand the fundamentals of operation of the main semiconductor electronic devices.
3. Understand the basic parameters of electronic devices, their performance, and limiting factors.
4. Understand the basic principles of electronic device operation with emphasis on bipolar transistors, and unipolar microwave devices.
5. To introduce the concepts and techniques associated with the number systems and codes. To minimize the logical expressions using Boolean postulates.
6. To design various combinational and sequential circuits

Syllabus:

UNIT I

Semiconductor Diode

PN junction diode theory, forward and reverse-biased junctions, reverse-bias breakdown, Zener and avalanche breakdown, load line analysis, behavior of PN junction characteristics, temperature dependence, concept of junction capacitance in forward and reverse bias conditions, diode characteristics, diode applications: rectifier, Clipper and clamper circuit, different types of diodes: zener diodes, varactor diodes, Tunnel diode, photo-diodes, LED, Schottky diode, Laser diodes.

UNIT II

Transistors: BJT, FET, MOSFET, Types, working principle, characteristics, and region of operation, load line, biasing methods (fixes biasing, self biasing), early effect.

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UNIT III

Transistors Amplifier: Small Signal BJT amplifiers: AC equivalent circuit, hybrid, re model and their use in amplifier design. Multistage amplifiers, frequency response of basic & compound configuration, Power amplifiers: Class A, B, AB, C and D stages, push-pull amplifier (their effficiency and power Dissipation).

UNIT IV

Feedback & Oscillator Circuits: Effect of positive and negative feedbacks, basic feedback topologies & their properties, Analysis of practical feedback amplifiers, Sinusoidal Oscillators, Operation of oscillators, types of transistor oscillators (RC, LC and Crystal), Multivibrators: Monostable and Astable Multivibrator, basic operation of the 555 timer.

UNIT V

Operational Amplifiers: Op-Amp Basics, ideal and practical Op-Amp circuits, differential and common mode operation, Inverting & Non Inverting Amplifier, OpAmp applications: Summing amplifier, Integrators and differentiators, Instrumentation amplifier.

List of Practicals:

1. V-I Characteristics of different types of Diodes.
2. Design of various clipping and clamping circuits.
3. Design half & full wave rectifier
4. Design & Analysis of transistor amplifier in CE, CB & CC configuration.
5. Design & Analysis of JFET Amplifier.
6. Design & Analysis of MOSFET Amplifier.
7. Study of power amplifiers of various classes.
8. Study of various oscillators.
9. Char. of Op-Amp (input offset voltage, slew rate CMRR, BW, Input bias current)
10. Study of Op-Amp as a comparator.

Text Books:

1. Engineering Physics by Dr. S. L. Gupta and Sanjeev Gupta, Dhanpat Rai Publication, New Delhi.
2. Neamen- Semiconductor Physics and Devices TMH
3. Bhattacharya & Sharma- Solid State Electronic Devices- Oxford
4. Maini & Agrawal- Electronics Devices and Circuits- Wiley
   Morris Mano, "Digital Design" PHI
5. "Digital Electronics", Bignill & Donovan.
6. "Digital Integrated Circuit" A.K.Gautam-Katson Publication.

Reference Books:

1. M. S. Tyagi, Introduction to Semiconductor Materials and Devices, John Wiley & Sons Inc.
2. Michael Shur, Introduction to Electronic Devices, John Wiley & Sons Inc., 2000.
3. R. T. Howe and C. G. Sodini, Microelectronics: An Integrated Approach, Prentice- Hall Inc. 1997.
4. Ben G. Streetman, Solid State Electronic Devices, PHI, 5th Ed, 2001.
5. Robert L Boylestad, Louis Nashelsky; Electronic Devices and Circuits; Pearson
6. J. B. Gupta, Electronic Devices and Circuits, Published by S K Kataria and Sons
7. Jacob Millman, Cristos C Halkias, Satyabrata Jit; Electronic Devices and Circuits; McGraw- Hill

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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSMENT				
BTME401	DCS	FLUID MECHANICS	60	20	20	30	20	3	0	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 20 marks.

Course Educational Objectives (CEOs):

To introduction with (A) Fluid and its properties, (B) behavior of fluid under various conditions, (C) Applications.

Course Outcomes (COs):

After the successful completion of this course students will be able to

1. Understand the fundamentals of fluid mechanics.
2. Understand basics of compressible flow.
3. Understand fundamentals of flow through pipes.
4. Understand statics, dynamics and various approaches to fluid mechanics.

Syllabus

Unit - I

Flow and Fluid Properties: Viscosity, relationship between stress and strain-rate for Newtonian fluids, incompressible and compressible flows, differences between laminar and turbulent flows. Hydrostatics forces: Buoyancy and floatation, manometer, forces on submerged and floating bodies, stability conditions.

Unit - II

Kinematics: Types of fluid flow, rate of flow or discharge continuity equation, velocity and acceleration, velocity potential function and stream function, types of motion, vortex flow.
Ideal flow: Uniform flow, source flow, sink flow, free vortex flow.

Unit - III

Differential Analysis: Differential equations of mass and momentum for incompressible flows, inviscid - Euler equation and viscous flows - Navier-Stokes equations, Bernoulli's equation from

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Euler's equation and assumptions, concept of fluid rotation, vorticity, stream function, Exact solutions of Navier-Stokes equation for Coquette Flow and Poiseuille flow, Orifices and mouthpieces: classifications of and flow through orifice, hydraulic coefficients, experimental determination of hydraulic coefficients, classification and flow through convergent and divergent mouthpiece.

Unit - IV

Dimensional Analysis: Introduction, secondary or derived quantities, methods of dimensional analysis, model analysis, similitudes-types of similarities, dimensionless numbers, models law and Concept of geometric, kinematic and dynamic similarity, some common non-dimensional parameters and their physical significance: Reynolds number, Froude number and Mach number. **Internal Flows:** Fully developed pipe flow, various losses in pipe flow, empirical relations for laminar and turbulent flows: friction factor and Darcy-Weisbach relation.

Unit-V

Prandtl Boundary Layer Equations: Concept and assumptions, qualitative idea of boundary layer and separation, streamlined and bluff bodies, drag and lift forces. Flow measurements: Basic ideas of flow measurement using venturimeter, Pitot - static tube and orifice plate.

Reference Books:

1. *"Fluid Mechanics and Fluid Power Engineering" by D.S. Kumar, S.K. Kataria & Sons*
2. *"Fluid Mechanics and Hydraulic Machines" by R.K. Bansal, Laxmi Publications*
3. *"Fluid Mechanics and Hydraulic Machines" by R.K. Rajput, S. Chand & Co.*
4. *"Fluid Mechanics" by Frank. M. White, McGraw Hill Publishing Company Ltd.*
5. *"Fundamentals of Fluid Mechanics" by Munson, Wiley India Pvt. Ltd*
6. *"Fluid Mechanics by A. K. Mohanty" PHI Learning Pvt. Ltd.*
7. *" Laboratory Manual Hydraulics and Hydraulic Machines" by R V Raikar*

List of Experiments

1. To understand pressure measurement procedure and related instruments/devices.
2. To study meta-centric height of floating body.
3. Verification of Bernoulli's Theorem.
4. To study the velocity of flow using Pitot tube.
5. To determine the Coefficient of discharge through different flow meters. (Any two out of Orifice meter, Venturimeter and Nozzle meter.)
6. To determine the different types of flow Patterns by Reynolds experiment.
7. To study the Friction factor for the different pipes.
8. To study the loss coefficients for different pipe fittings.

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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTEE 404		ELECTROMAGNETIC FIELD THEORY	3	0	0	3	60	20	20	0	0

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:
To lay the foundations of electromagnetism and its practice in modern communications such as wireless, guided wave principles. To provide the basic skills required to understand, develop, and design various engineering applications involving electromagnetic fields.

Course Outcomes:
After the successful completion of this course students will be able to:

1. Use different coordinate system and apply them to solve real time multidisciplinary issues
2. Apply vector calculus to understand the behavior of static electric fields in standard configurations
3. Apply vector calculus to understand the behavior of static magnetic fields in standard configurations
4. Analyze Maxwell's equation in different forms (differential and integral) and apply them to diverse engineering problems
5. Describe and analyze electromagnetic wave propagation in free-space

Syllabus:

UNIT I
ELECTROSTATICS – I
Sources and effects of electromagnetic fields – Coordinate Systems – Vector fields –Gradient, Divergence, Curl – theorems and applications - Coulomb's Law – Electric field intensity – Field due to discrete and continuous charges – Gauss's law and applications.

UNIT II
ELECTROSTATICS – II
Electric potential – Electric field and equipotential plots, Uniform and Non-Uniform field, Utilization factor – Electric field in free space, conductors, dielectrics - Dielectric polarization - Dielectric strength - Electric field in multiple dielectrics – Boundary conditions, Poisson's and Laplace's equations, Capacitance, Energy density, Applications.

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UNIT III
MAGNETOSTATICS

Lorentz force, magnetic field intensity (H) – Biot–Savart's Law - Ampere's Circuit Law – H due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (B) – B in free space, conductor, magnetic materials – Magnetization, Magnetic field in multiple media – Boundary conditions, scalar and vector potential, Poisson's Equation, Magnetic force, Torque, Inductance, Energy density, Applications.

UNIT IV
ELECTRODYNAMIC FIELDS

Magnetic Circuits - Faraday's law – Transformer and motional EMF – Displacement current - Maxwell's equations (differential and integral form) – Relation between field theory and circuit theory – Applications.

UNIT V
ELECTROMAGNETIC WAVES

Electromagnetic wave generation and equations – Wave parameters; velocity, intrinsic impedance, propagation constant – Waves in free space, lossy and lossless dielectrics, conductors- skin depth - Poynting vector – Plane wave reflection and refraction – Standing Wave ratio– Transmission lines – Line equations – transmission line parameters.

Text Books:

1. Mathew N. O. Sadiku, 'Principles of Electromagnetics', 4 th Edition ,Oxford University Press Inc.First India edition, 2009.
2. Ashutosh Pramanik, 'Electromagnetism – Theory and Applications', PHI Learning Private
   Limited, New Delhi, Second Edition-2009.
3. K.A. Gangadhar, P.M. Ramanthan ' Electromagnetic Field Theory (including Antennaes and wave propagation', 16th Edition, Khanna Publications, 2007.

Reference Books:

1. Joseph. A.Edminister, 'Schaum's Outline of Electromagnetics, Third Edition (Schaum's Outline Series), Tata McGraw Hill, 2010
2. William H. Hayt and John A. Buck, 'Engineering Electromagnetics', Tata McGraw Hill 8th Revised edition, 2011.
3. Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International Editions, Fifth Edition, 2010.
4. Bhag Singh Guru and Hüseyin R. Hiziroglu "Electromagnetic field theory Fundamentals",Cambridge University Press; Second Revised Edition, 2009.

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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSMENT*				
BTME402	DCS	THEORY OF MACHINES	60	20	20	30	20	3	1	2	5

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P-Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 20 marks.

Course Educational Objectives (CEOs):

This course provides comprehensive knowledge of (A) Mechanism and machine (B) Kinematics of plane motion, (C) Cam and Follower, (D) Gears and Gear Train, (E) Gyroscope.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. Students will be able to define systematically design and develop mechanisms to perform a specified task and demonstrate an understanding of the concepts of various mechanisms and pairs.
2. Students will be able to do the velocity and acceleration analysis of simple mechanisms.
3. Students will be able to explain effectively present written, oral, and graphical solutions to design problems & develop ability to come up with innovative ideas and design a layout of cam for specified motion.
4. Students will be able demonstrate an understanding of principle of gears.
5. Students will be able to synthesis simple gyroscopic forces and couple, and gyroscopic effect in airplanes, ship and vehicle.

Syllabus

Unit - I

Mechanisms and Machines: Mechanism, machine, plane and space mechanism, kinematic pairs, kinematic chains their classification, degrees of freedom, Grubler's criterion, kinematics inversions four bar mechanism and slider crank mechanism, equivalent linkages, pantograph, straight line motion mechanism, Devis and Ackermann's steering mechanism, Hooke;s joint.

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Unit - II

Motion: kinematics of Plane motion, Absolute & Relative motion, Displacement, Velocity and Acceleration Analysis by Graphical & Analytical methods, Velocity image, Velocity of rubbing, Kennedy's Theorem, Acceleration image, Acceleration polygon, Coriolis acceleration component, Klein's construction, Velocity and Acceleration Analysis using complex Raven's methods..

Unit - III

Cams: Classification of Cams and Followers, Radial Cam Terminology, Analysis of Follower motion (uniform, modified uniform, simple harmonic, parabolic, cycloidal), Pressure Angle, Radius of Curvature, Cam Profile for radial and offset followers Synthesis of Cam Profile by Graphical Approach.

Unit - IV

Gears: Classification of gears and its type, Gear Terminology, Law of gearing, Tooth profiles, velocity of sliding, Path of contact, Arc of contact, Contact Ratio, Interference and Undercutting, Conjugate action.

Gear Trains: Simple, compound, reverted and epi-cyclic gear trains. Velocity ratio and torque calculation in gear trains

Unit - V

Gyroscope: Gyroscopic Action in Machines, Angular Velocity and Acceleration, Gyroscopic torque/ couple, Gyroscopic effect on Naval Ships, Stability of Two and Four Wheel Vehicles, Rigid disc at an angle fixed to a rotating shaft.

Reference Books:

1. *"Mechanism and Machine Theory" by Ambekar AG; PHI. Eastern Economy Edition 2015*
2. *" Theory of machines & Mechanism " by Uicker & Shigley, Second Edition Oxford University Press*
3. *"Theory of Machines" by Dr. Jagdish Lal; Metropolitan Book Co; Delhi*
4. *"Mechanism and Machine Theory" by Rao J S and Dukkipati; New Age Delhi.*
5. *"Theory of Machines", by S.S. Rattan, (2009), Third Edition, Tata McGraw-Hill*

List of Experiments

1. To synthesize and demonstrate the inversion of four bar mechanism through animation and model.
2. To synthesize and demonstrate the inversion of single slider and double slider crank mechanism through animation and model.

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3. To construct and demonstrate the steering mechanism based on Davis & Ackermann's Steering mechanisms principles.
4. To find out velocity & acceleration of slider crank mechanism by Klein's Construction.
6. To draw Involutes profile of a gear by generating method.
7. To find out velocity ratio of various gear trains.
8. To study working of sun and planet epicycle gear train mechanism using models
9. To study various types of belt drives & find out the velocity ratio of the drive.
10. To finds out gyroscopic couple.

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COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTEC 408		SIGNAL & SYSTEM	2	1	2	4	60	20	20	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

The objective of this course is to have an introduction to approaches of signals & systems analysis with an increased emphasis on the frequency response and Analysis of system with continuous signal and discrete time signal. To enable the students to understand the fundamentals of signals, their time & frequency characteristics.

Course Outcomes:

After the successful completion of this course students will be able to

1. Classify both continuous and discrete time signals and systems.
2. Analyze continuous signals in complex plain.
3. Understand Laplace transform and z transform.
4. Understand the random signals and systems.

Syllabus:

UNIT I

Introduction to signal and systems: Classification, definition and representation of various types of Signals, representation of basic time domain functions, Various signal operations: shifting, scaling and inversion. System properties: Linearity, Causality, time invariance and stability, Dirichlet's conditions, Determination of Fourier series coefficients of signal.

UNIT II

Signal Transformation: Fourier transformation of continuous and discrete time signals and their properties, Fourier transformation-analysis with examples and properties, Parseval's theorem. Convolution in time and frequency domain with magnitude and phase response of LTI systems.

UNIT III

Laplace Transform: Definition, Region of Convergence, Laplace Transform of some important functions, Convolution Integral and Inverse Laplace Transform. Properties of Laplace Transform. Concepts of s-plane Poles and Zeros & its Plot. Applications of Laplace Transformation in analysing networks.

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UNIT IV

Z-Transforms: Basic principles of z-transform, z-transform definition, Relationship between z-transform and Fourier transform. Region of convergence and properties of ROC, Properties of z-transform, Poles and Zeros, inverse z-transform using Contour integration, Residue Theorem, Power Series expansion and Partial fraction expansion.

UNIT V

Random Signals & Systems: Definitions, distribution & density functions, mean values & moments, function of two random variables, concepts of correlation, random processes, spectral densities, response of LTI systems to random inputs.

List of Practicals:

1. Introduction to MATLAB
2. Write a program to generate continuous time signals (i) Sine wave (ii) Cosine Wave (iii) Square wave (iv) Triangular wave
3. Write a program to generate the discrete sequences (i) unit step (ii) unit impulse (iii) ramp (iv) periodic sinusoidal sequences. Plot all the sequences.
4. Find the Fourier transform of a square pulse .Plot its amplitude and phase spectrum.
5. Write a program to convolve two discrete time sequences. Plot all the sequences. Verify the result by analytical calculation.
6. Generate a discrete time sequence by sampling a continuous time signal.
7. Write a program to find the autocorrelation and cross correlation of sequences.
8. Write a program to generate a random sinusoidal signal and plot four possible realizations of the random signal.

Text Books:

1. Alan V. Oppenheim, Alan S. Willsky, with S. Hamid, Signals and Systems 2/E, 1996 Prentice Hall.
2. J. G. Proakis, D. G. Manolakis, Digital Signal Processing –Principles, algorithms and applications, 3rd Edition, 1996 PHI.

Reference Books:

1. Hwei Hsu, Schaum's Outline of Signals and Systems 1st, 1995 McGraw-Hill.
2. Simon Haykin and Van Veen, Signals & Systems 2nd Edition, 2002, Wiley.
3. Robert, Signals & Systems Analysis Using Transformation Methods & MATLAB, 2003 TMH.
4. C. L. Philips, J.M.Parr and Eve A.Riskin Signals, Systems and Transforms 3rd Edition, 2004 Pearson education.
5. I. J. Nagrath, S.N.Sharan, R.Ranjan, S.Kumar, Signals & Systems, 2001.

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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTCE 505	DCS	ADVANCED SURVEYING	2	1	2	4	60	20	20	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:
To collect the knowledge about significance of advanced surveying in field measurements in terms of utility and precision of data collection.

Course Outcomes:

1. To know about significance of advanced surveying in field measurements in terms of utility and precision of data collection
2. To get introduced to the concept of photogrammetry in preliminary identification and map making
3. To know in detail the concept of remote sensing in identification of land features from space and to get introduced to different data acquisition techniques.
4. To get introduced to the field of geodesy, coordinate systems, Map projections, GPS, its working principles, data collection, data processing and analysis

Syllabus:

UNIT I
Triangulation Horizontal and vertical control, Methods, specifications, triangulation, baseline, instruments and accessories, corrections, satellite stations, reduction to center, single and reciprocal observations, traversing, Gale's table.

UNIT II
Theory of Errors Introduction, types of errors, definitions, laws of accidental errors, laws of weights, theory of least squares, rules for giving weights and distribution of errors to the field observations, determination of the most probable values of quantities.

UNIT III
Total Station: Total Station – Parts of a Total Station – Accessqries –Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey

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DGPS:-Introduction & components of DGPS, Elements of Satellite based surveys-Map datums, DGPS receivers, DGPS observation methods and their advantages over conventional methods

UNIT IV

Aerial photogrammetry: Introduction, Principle, Uses, Aerial camera, Aerial photographs, Definitions, Scale of vertical and tilted photograph, Ground Co-ordinates, Displacements and errors, Ground control & Procedure of aerial survey, Photomaps and mosaics, Stereoscopes & Parallax bar.

UNIT V

Remote Sensing and GIS

Remote Sensing:-Introduction, Principles of energy interaction in atmosphere and earth surface features, Image interpretation techniques, visual interpretation, Digital image processing,

GIS:-Definition of GIS , Key Components of GIS & Functions of GIS, Spatial data, spatial information system, Geospatial analysis, Integration of Remote sensing and GIS, and Applications.

Text Books:

1. Surveying and Leveling-Part-I & II by T.P. Kanetkar and S.V. Kulkarini, Pune Vidyarthi Griha Prakashan, Pune
2. Engineering Surveying: Theory and Examination Problems for Students by W. Schofield, Butterworth Heinemann,Oxford.
3. Surveying: Problems Solving with theory and objective type questions by A.M. Chandra, New Age International Publishers N. Delhi.

Reference Books:

1. Advance Surveying by A.M. Chandra, New Age International Publishers N. Delhi.
2. Surveying Vol. II by S.K. Duggal, Tata McGraw Hill Publishing Company Ltd. New Delhi.
3. Remote Sensing and image interpretation by Lillesand T.M. and Kiefer R.W.

List of Practical's:

1. Prepare contour maps of ground surface.
2. Determine the water storage capacity in case of probable storage site assuming the height of barriers located at selected places.
3. Calculate the height of building using total station.
4. Calculate the height of building using digital theodolites.
5. Measure the distance between two points of field using total station.

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