VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

Scheme of Teaching and Examinations – 2020 - 21

M.Tech (Geoinformatics)

Choice Based Credit System (CBCS) and Outcome Based Education(OBE)

I SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours per Week			Examination				Credits
				Theory	Practical	Skill Development Activities	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
1	PCC	20CGI11	Geospatial statistics	03	--	02	03	40	60	100	4
2	PCC	20CGI12	Principles of Remote Sensing	03	--	02	03	40	60	100	4
3	PCC	20CGI13	Geographic Information Systems (GIS) and Spatial Data Analytics	03	--	02	03	40	60	100	4
4	PCC	20CGI14	Principles of Photogrammetry	03	--	02	03	40	60	100	4
5	PCC	20CGI15	Geospatial Database Management Systems and Programming Skills	03	--	02	03	40	60	100	4
6	PCC	20CGIL16	Geoinformatics Laboratory- I	--	04	--	03	40	60	100	2
7	PCC	20RMI17	Research Methodology and IPR	02	--	02	03	40	60	100	2
			TOTAL	**17**	**04**	**12**	**21**	**280**	**420**	**700**	**24**

Note: PCC: Professional core.

Skill development activities:

Students and course instructor/s to involve either individually or in groups to interact together to enhance the learning and application skills.

The students should interact with industry (small, medium and large), understand their problems or foresee what can be undertaken for study in the form of research/ testing / projects, and for creative and innovative methods to solve the identified problem.

The students shall

(1) Gain confidence in modelling of systems and algorithms.
(2) Work on different software/s (tools) to Simulate, analyse and authenticate the output to interpret and conclude.
(3) Operate the simulated system under changed parameter conditions to study the system with respect to thermal study, transient and steady state operations, etc.
(4) Handle advanced instruments to enhance technical talent.
(5) Involve in case studies and field visits/ field work.
(6) Accustom with the use of standards/codes etc., to narrow the gap between academia and industry.

All activities should enhance student's abilities to employment and/or self-employment opportunities, management skills, Statistical analysis, fiscal expertise, etc.

Internship:

All the students have to undergo mandatory internship of 6 weeks during the vacation of I and II semesters and /or II and III semesters. A University examination shall be conducted during III semester and the prescribed internship credit shall be counted for the same semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as fail in internship course and have to complete the same during the subsequent University examination after satisfying the internship requirements.

Note:

(1) Four credit courses are designed for 50 hours Teaching – Learning process.

(2) Three credit courses are designed for 40 hours Teaching – Learning process.

(3) Two credit courses are designed for 25 hours Teaching – Learning process.

Geospatial Statistics			
Course Code	20CGI11	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Basic Concepts: Histogram – univariate and bivariate, estimation of basic statistical parameters, viz., mean, standard deviation, variance, covariance.

Probability Theory: Introduction to probability theory, kinds of probability – classical or apriority probability, A posteriori or Frequency probability, probability models, an inside to set theory, sample space and events, conditional, joint probability and independence.

Module-2

Special Parametric Families of Univariate and Multivariate Distributions: Introduction and summary, Discrete and continuous distributions – binomial, poisson, exponential, Gaussian/Normal distribution functions, joint and continuous distributions, bivariate and multivariate normal distribution.

Estimation Theory: Introduction and summary, methods of finding estimators, properties of point estimators, unbiased estimation, location or scale invariance, Bayes estimators – posterior distribution, loss function approach, min-max estimators, maximum likelihood estimators

Module-3

Stratification and Sampling: Introduction, sampling, sample mean, sampling from normal distribution, stratification and sampling.

Testing of Hypothesis: Introduction and summary, simple hypothesis testing, composite hypothesis, tests of hypotheses – sampling from normal distribution, chi-square tests, tests of hypotheses and confidence intervals, sequential test of hypotheses**.**

Module-4

Geo-statistics for Spatial Analysis and Modelling: Cluster analysis concepts and techniques, Spatial autocorrelation, Multivariate Correlation, Linear regression, Multiple regressions. Statistical Surfaces-Interpolation, Variogram, Kriging. Geostatistical models, stochastic models, probabilistic models, Deterministic models.

Time Series and Forecasting: Introduction, variation in time series, trend analysis, time series analysis in forecasting

Module-5

Introduction to Spatial data analysis in R: Basic data types and data structures in R Looping, functions, Data types in GIS, Visualising Spatial Data, Spatial Data Import and Export, Working with vector data in R, Working with raster data in R, Classification of Remote Sensing Images.

Course outcomes:

At the end of the course the student will be able to:

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

(1) 1.Richard I.Levin, David S. Rubin, Sanjay Rastogi, Masood Hussain Siddiqui, Statistics for Management, 7th edition, Pearson Education Inc,2013

(2) Spatial Statistics and Computational Methods, ISBN:0387001360

Reference Books

(1) Chris Brunsdon and Lex Comber, SAGE(2015), "An Introduction to R Spatial Analysis and Mapping"

(2)

(3)

PRINCIPLES OF REMOTE SENSING

Course Code	20CGI12	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Introduction: Definition of terms, Concepts and types of remote sensing; evolution of remote sensing technology, stages in remote sensing technology, spatial data acquisition, interdisciplinary nature and relation with other disciplines, applications of remote sensing, advantages of RS over conventional methods of survey.

Basic Principles of Remote Sensing: Electro-magnetic radiation; Interactions between matter and electro-magnetic radiation; Types of remote sensing with respect to wavelength regions; Definition of radiometry; Black body radiation; Reflectance; spectral reflectance of land covers; Spectral Signatures; Radiative transfer equation; energy interaction in the atmosphere.

Module-2

Sensors: Types of sensors- passive sensors and active sensors; imaging systems, photographic sensors, characteristics of optical sensors; Sensor resolutions, characteristic of optical detectors; non-imaging radiometers, imaging sensors, Panchromatic, Multispectral, hyperspectral, Optical mechanical line scanner; Push broom scanners and whisk-broom scanners; Imaging spectrometer; space borne imaging sensors, microwave sensors; Thermal sensors.

Platforms: Types of platforms- airborne remote sensing, space borne remote sensing; Atmospheric condition and altitude; Attitude of platform; Attitude sensors; Orbital elements of satellite; types of orbits, Satellite positioning systems including GNSS, IRNSS, etc, Various satellites for Land, Ocean, and atmospheric studies.

Module-3

Image Interpretation and Analysis: Fundamentals of aerial photos and satellite image interpretation; Types of imaging, elements of interpretation, Generations of Thematic maps. Importance of ground truth, reference data, use of smart phone, geo-tagging.

Module-4

Digital Image Processing: Data reception and data products**,** Digital data manipulation and analysis; image rectification – Radiometric correction, Atmospheric correction, Geometric correction;

Module-5

Advanced Remote Sensing Technologies: Microwave remote sensing, Synthetic Aperture Radar; Hyper spectral Imaging Spectrometer; Thermal Imaging System; Advanced Laser Terrain Mapping.

Course outcomes:

At the end of the course the student will be able to:

The students will be familiarized with the Fundamentals of Remote Sensing

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.

Reference Books

(1) Fundamentals of Remote Sensing: George Joseph

(2) Remote Sensing and Image Interpretation: Lillesand & Keifer.

(3) Physical aspects of Remote Sensing: PJ Curran.

(4) Remote Sensing Principles and Interpretation: F.F. Sabins.
(5) Introduction to Remote Sensing: J.B. Campbell.
(6) Introductory Digital Image Processing: A Remote Sensing Perspective, John R Jensen, 4th ed, 2016
(7) Remote sensing Models and methods for image processing by Robert A. Schowengerdt, second edition, 1997, Academic Press

GEOGRAPHIC INFORMATION SYSTEMS &

SPATIAL DATA ANALYTICS

Course Code	20CGI13	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Introduction to GIS: Definitions, history and evolution, place of GIS in Geoinformatics, Components of GIS, interdisciplinary relations, Discrete geographic objects, Continuous geographic features, Vector and Raster Data structures, GIS application areas, careers in GIS.

Spatial Data Types and Models: Spatial Data types, Non-spatial / Attribute Data types, Tessellations to represent geographic objects, Data models: Basic Data Models –raster and vector, Spaghetti model and Topological model, Advanced data models, raster and vector data formats.

Module-2

Data Sources and Data Entry: Primary and secondary methods of acquisition of spatial and non-spatial data: surveying, remote sensing, Photogrammetry, Global Navigation Satellite System (GNSS), Database creation, Data capturing, map scanning and digitizing, data exchange standards, topology building, editing and cleaning, linking of spatial and non-spatial data.

Module-3

Data Processing: Hardware and software needed**,** Database Management Systems (DBMS), Linking GIS and DBMS, Raster and Vector data editing, data conversion, Corrections, scale changes, Coordinate thinning, Georeferencing and map projections, sliver removal, edge matching, interactive editing, rubber sheeting.

Data Quality and Standards: Definition of data quality, components of geographic data quality, Sources of error in geographic data, error propagation and error management; quality assurance & quality control (QA/QC). Geographic data standards, components and types of GIS standards, international GIS standards, interoperability of GIS.

Module-4

Spatial Data Analysis and Integration: Spatial Measurements, Queries, Vector Data Analysis, Raster Data Analysis, Network Analysis, Terrain analysis, spatial analysis of 3-Dimentional data, Data integration and map overlay.

Data Visualization: GIS and Maps**,** Visualization process, visualization strategies, mapping qualitative and quantitative data, map / information dissemination.

Module-5

Advanced Spatial Data Analysis and Modelling: Trend surface analysis, Spatial interpolation, fuzzy analysis, GIS analytical models: Digital Terrain Models, Hydrologic modelling, Spatial Multi Criteria Analysis

and engineering GIS applications, recent advances in GIS & Spatial Data Analytics (SDA), Career opportunities in GIS and SDA.

Course outcomes:

At the end of the course the student will be able to:

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Reference Books

(1) Concepts and Techniques of Geographic Information Systems, CP Lo Albert K W Yeung, 2005 Prantice Hall

(2) Principles of GIS for Land Resources Assessment by P.A.Burrough, Oxford: Science publications, 1986.

(3) Geographic Information Systems – An introduction by Tor Bernhardsen, John Wiley and Sons, Inc., New

(4) GIS – A computing Perspective by Michael F. Worboys, Taylor & Francis, 1995.

(5) Remote Sensing and Image Interpretation by Thomas M. Lillesand and Ralph W. Kiefer, John Wiley and Sons Inc., New York, 1994.

(6) Geographical Information Systems – Principles and Applications, Volume I edited by David J. Maguire, Michael F Goodchild and David W Rhind, John Wiley Sons. Inc., New York 1991.

(7) Geographical Information Systems – Principles and Applications, Volume II edited by David J. Maguire, Michael F Goodchild and David W Rhind, John Wiley Sons. Inc., New York 1991.

PRINCIPLES OF PHOTOGRAMMETRY

Course Code	20CGI14	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Introduction: Definition and terms, history of photogrammetry, concepts; Basics of photogrammetry; Applications; Photo products; Types of aerial photographs: vertical photographs, tilted photographs, Geometry of aerial photograph: scale, relief displacement, scale of tilted photograph; aerial cameras, its accessories and working principles, Resolution, Image movement ; Analog and digital imaging devices; their characteristics and advantages over other analogue cameras; Photo interpretation.

Stereoscopy: Principles of stereoscopic vision, types of stereoscopes, stereoscopic viewing, stereoscopic parallax.

Module-2

Analytical Photogrammetry: Purpose of fiducial marks, Image coordinate system and Object space coordinate system; image measurements in analytical plotter, Minor Control Points (MCPs), analytical interior orientation, analytical relative orientation, analytical absolute orientation, collinearity equations of vertical and tilted photograph, Epipolar geometry co-planarity equations, Relationship between image and object space

Orientation Procedures: Basic photogrammetric operation in digital environment, Inner Orientation, Exterior Orientation procedures in digital photogrammetry, advantage of digital IO and EO over analogue and analytical system.

Module-3

Project Planning: Flight planning, choice of photo scale, photographic end lap and side lap, purpose of photography, ground coverage, weather conditions, season of the year, flight map, specifications, cost estimation and scheduling, use of Drone / Unmanned Aerial Vehicles (UAV) system in image capturing, Ground Sampling Distance (GSD).

Ground Control for Aerial Photogrammetry: General requirements of ground control points; Selecting photo control points and its location on photo, planning Block Control Points (BCP), Artificial targets for photo identifiable control points, pre-pointing and post pointing, indexing ground control points.

Module-4

Aero Triangulation(AT): Definition, Classification of AT, GPS supported AT, geometric relationship between a camera and GPS antenna with respect to its position and attitude, synchronization of GPS coordinates with camera exposures, entering GPS coordinates, and INS parameters in bundle block adjustments for each exposure stations.

Concept of Block/Bundle/Strip Adjustments: definition of block, types of block adjustments, development of block adjustment; bundle block adjustment, accuracy of block adjustment, space resection, space intersection, reasons for digital AT superior over analogue AT. Artificial Intelligence (AI) in Bundle adjustment**.**

Module-5

Soft copy Photogrammetry: Digital photogrammetric system, Configuration of Digital photogrammetric work station, photogrammetric scanners, softcopy photogrammetry, 3D visualization in digital environment (stereo-viewing), Quad buffer, characteristics of digital image data, image enhancement, image matching, feature extraction by 2D and 3D mode, Advantages of digital photogrammetry.

Introduction to DTM: Digital surface modelling by DTM/DEM, Interpolation techniques, GRID and TIN, break lines, profiles, mass points / random points, DTM generation process, differential rectification, mosaic, Seamless data generation.

Photogrammetry and GIS: Data Model Structure (DMS), input data from photogrammetry for GIS database, photogrammetric applications in GIS.

Course outcomes:

At the end of the course the student will be able to:

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Reference Books

(1) Elements of Photogrammetry with applications in GIS by Paul R Wolf and Bon A. Dewitt, 3rd edition, 2004, ISBN 007-123689-9

(2) Aerial Photography and Image interpretation second edition by David P paine, and James D Kiser, 2003, John Wiley and Sons Inc. ISBN 0-471-20489-7

(3) Interpretation of Aerial Photographs: TE Avery

(4) Elementary Air Survey: W. Kilford.

(5) Manual of Photogrammetry: ASP Falls Church Virginia.
(6) Modern Photogrammetry by Edward M Mikhail
(7) Photogrammetry Vol. I- Kranss

GEOSPATIAL DATABASE MANAGEMENT SYSTEMS AND PROGRAMMING SKILLS

Course Code	20CGI15	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Databases and Users: Introduction, characteristics of database approach, intended uses of a DBMS, implications of database approach.

Database System Concepts and Architecture: Data models, schemas and instances, DBMS architecture and data independence, database languages and interfaces, database system environment, classification of database management systems.

Data Modelling: Conceptual data models for database design, ER model- concepts, schema constructs and simple applications.

Module-2

Record Storage and Primary File Organizations: Secondary storage devices, buffering of blocks, placing file records on disk, operations on files – heap files and sorted files – hashing techniques.

Index Structure of Files: Single level and multilevel ordered indexes, dynamic multilevel indexes using B- tree and B+ tree

Relational Data Model: Concepts and constraints, update operations on relations, relational algebra, simple examples.

Module-3

Database design: Functional dependencies and normalization for relational databases, Normal forms based on primary keys, gene general definition of second and third normal forms, Boyce-Codd normal form.

Structured Query Language: Data definition in SQL, queries, update statements, views in SQL, DDL, and DML. Relation Database Management System, querying operation. Object–relational database management system (ORDBMS), Distributed databases, web services and XML, OLAP (Online Analytical Processing), OLTP (Online transaction processing).

Module-4

Spatial Database Management System: Introduction, concepts and data model, spatial query, spatial indexing (R- tree, Gird, files), Spatial network, Spatial data mining and Warehousing. Concurrency an

Recovery concepts.

Module-5

Python Scripting: Introduction, Environment setup, Debugging, Syntax, Variable Types, Operators, Decision statements, Loops, Numbers, Strings, Lists, Tuples, Dictionary, Modules, File I/O, Exceptions & Exception Handling, Arrays-2D, Classes & Objects, Classes & functions, Inheritance and Polymorphism.

Course outcomes:

At the end of the course the student will be able to:

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.

Reference Books

(1) Elmasri R. and Navathe S.B., "**Fundamentals of Database Systems**", Benjamin/Cummings Publishing Co. Inc. (Addison- Wesley world student series), 2002

(2) Dr. R Nageswara Rao., "Core Python Programming" Second edition.

(3) Trembley J.P. and Sirenson P.G., "**An Introduction to Data Structures with Applications**", Tata McGraw-

(4) Date C.J., "**An Introduction to Database Systems**", Vol-I, Addison-Wesley.

(5) A.Silberschatz, H.F.Korth and S.Sudarshan, "**Database System Concepts**", McGraw-Hill International

GEOINFORMATICS LABORATORY- I			
Course Code	20CGIL16	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	0:4:0	SEE Marks	60
Credits	02	Exam Hours	03

Sl. NO	Experiments
1	Familiarization with Maps of different scales (SOI Toposheets) Familiarization with Monochromatic and Multispectral Satellite Imagery (Creation of FCC) Downloading Satellite Images
2	Geometric Correction of Satellite Data(Georeferencing, Mosaicking andSubsetting) Atmospheric & Radiometric Correction of Satellite Images
3	Visual Interpretation of Aerial photographs & Satellite Imagery and area measurement
4	Import and Export of Satellite data to various formats using different
5	softwareCreating Geodatabase using ArcGIS Spatial Data creation using field data in GIS Software environment
6	Feature extraction (Vectorization) using GIS Software Familiarization in open source like (Q- GIS)
7	Stereo Test Familiarization with Mirror Stereoscope Familiarization with the use of Parallax Bar Determination of height of objects from stereo pairs
8	Feature extraction and tracing of details from stereo pairs Demonstration on Digital Photogrammetric Station Orthophoto generation, Mosaicking
9	Installation, Connections using CMD, DBCMD, Simple querying and displaying data, exporting output to a file /DB Simple python and R Programs Listing, Tuples and
10	Visualizing of spatial data in R, Layer stacking of bands and generation of program using R program.

Course outcomes:

At the end of the course the student will be able to:

Students will be equipped with modern tools, softwares of GIS and be confident to implement a GIS project independently or as a team effort.

Research Methodology and IPR			
Course Code	20RMI17	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	1:0:2	SEE Marks	60
Credits	02	Exam Hours	03

Module-1

Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India.

Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration.

Module-2

Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.

Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental

Module-3

Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs.

Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale.

Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data,

Module-4

Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis.

Chi-square Test: Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit, Cautions in Using Chi Square Tests.

Module-5

Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999,The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act1999, Copyright Act,1957,The Protection of Plant Varieties and Farmers' Rights Act, 2001,The Semi-Conductor Integrated Circuits Layout Design Act, 2000,

Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organisation (WIPO),WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of Protection, Trade Related Aspects of Intellectual Property Rights(TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO. ■

Course outcomes:

At the end of the course the student will be able to:

- Discuss research methodology and the technique of defining a research problem
- Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review.
- Explain various research designs, sampling designs, measurement and scaling techniques and also different methods of data collections.
- Explain several parametric tests of hypotheses, Chi-square test, art of interpretation and writing research reports

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.

Textbooks

(1) Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg,New Age International,4th Edition, 2018.

(2) Research Methodology a step-by-step guide for beginners. (For the topic Reviewing the literature under module 2), RanjitKumar,SAGE Publications,3rd Edition, 2011.

(3) Study Material (For the topic Intellectual Property under module 5),

Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September 2013.

Reference Books

(1) Research Methods: the concise knowledge base, Trochim, Atomic Dog Publishing, 2005.

(2) Conducting Research Literature Reviews: From the Internet to Paper, Fink A, Sage Publications, 2009.