# UTTARANCHAL UNIVERSITY

## Pre Ph.D. (Mechanical Engineering)


## Course Structure for

## Pre Ph.D. (Mechanical Engineering) Course Work

## (As per CBCS system)

## Session 2020-21

**Approved by the Academic Council meeting held on**

# Structure of the Pre-Ph.D(Mechanical Engineering) Course Work:

The Course Work shall consist of four subjects of total 16(5+5+4+2) Credit with the following scheme pattern

**Scheme of Pre-Ph.D. Course Work**

| S.No | Course Code | Subject | Credits | Evaluation – Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Period | | | Sessional | | | Examination | |
| | | | | L | T | P | CT- I | CT-II | Total | ESE | Sub. Total |
| **Courses** | | | | | | | | | | | |
| 1. | RM-101 | Research Methodology & Computer Application | 5 | 4 | 1 | 0 | 20 | 20 | 40 | 60 | 100 |
| 2. | ME-102 | Discipline Specific Electives (Mechanical Engineering) | 5 | 4 | 1 | 0 | 20 | 20 | 40 | 60 | 100 |
| 3. | RLS-103 | Review of Literature&Seminar Presentation | 4 | 0 | 0 | 10 | 20 | 20 | 40 | 60 | 100 |
| 4. | RPE-104 | Research & Publication Ethics | 2 | 2 | 0 | 0 | 20 | 20 | 40 | 60 | 100 |
| | | **Total** | **16** | **10** | **2** | **10** | **80** | **80** | **160** | **240** | **400** |

Discipline Specific Electives (DSE):- Any one has to be opted by the scholar or any course from PG level may be opted with the approval of Departmental Research Committee/RDC.

Electives are-

ME-102 (1)-FINITE ELEMENT METHOD

ME-102 (2)-FRACTURE MECHANICS

ME-102 (3)-COMPUTATIONAL FLUID DYNAMICS

ME-102 (4)-ADVANCED HEAT & MASS TRANSFER

ME-102 (5)-DESIGN AND ANALYSIS OF SOLAR ENERGY SYSTEMS

ME-102 (6)-CNC, FMS & CIM

ME-102 (7)-ADVANCED MATERIAL SCIENCE AND ENGINEERING

# Detailed Syllabus

## RM 101: Research Methodology

| Code | Course Name | Credit | L | T | P | CT-1 | CT-II | CT-Total | ESE | G. Total |
|---|---|---|---|---|---|---|---|---|---|---|
| RM-101 | Research Methodology & Computer Application | 5 | 4 | 1 | 0 | 20 | 20 | 40 | 60 | 100 |

**Course Objective:**

The Objectives of the Courses

1. To Equip the Students with the Concept and Methodology of Research.
2. To provide knowledge about type of research, preparation of reports and thesis, designing of Research using Scientific Methods like statistical methods and computer skills.

**Contents:**

**UNIT-I**

Introduction to Research: Definition, Nature and significance, Role and Objectives; Types of Research: exploratory, descriptive, experimental and diagnostic research, social and legal research and traditional, analytical, empirical & fundamental research, Doctrinal and non-doctrinal research methods; Various Research Designs; Scientific Research Process: Overview, Problem identification and formulation of research statement.

**UNIT-II**

Data Collection: sources, primary and secondary methods, significance of Primary and Secondary Data, questionnaire Vs. schedules; Data Processing: Editing, Coding Organization and Presentation; Attitude Measurement and scaling: Measurement Scales, Sources of Errors in Measurement, Techniques of Developing Measurement Tools, Classification and Testing (Reliability, Verification and Validity) Scales, Designing Questionnaires and Interviews.

**UNIT-III**

Sampling, Sampling Methods, Sampling Plans, Sampling Error, Sampling Distributions: Theory and Design of Sample Survey, Census Vs Sample Enumerations, Objectives and Principles of Sampling, Types of Sampling, Sampling and Non-Sampling Errors.

**UNIT-IV**

Statistical Tools / Methods for research – Univariate and Bivariate Analysis. Hypothesis and Hypothesis Testing: Parametric & Non-Parametric Tests, Correlation and Regression, U Test, Mean Deviation & Standard Deviation, Concept of Permutation, Combination & Probability, Chi Square Test, T-Test.

**UNIT-V**

Interpretations and Report Writing: Meaning of Interpretation, Techniques of Interpretation, Precautions in Interpretation, Significance of Report Writing, Steps in Report Writing, Layout of Report and Precautions in Writing Research Reports. Limitations of RM: Ethics in Research, Philosophical Issues in Research.

**Text Readings**


1. William G. Zikmund, "Business Research Methods", Orlando: Dryden Press.
2. C. William Emory and Cooper R. Donald, "Business Research Methods", Boston, Irwin.
3. Fred N Kerlinger, "Foundations of Behavioural Research", New Delhi: Surjeet Publications.
4. Naresh Malhotra, Marketing Research : An Applied Orientation, Pearson publication David

Nachmias and ChavaNachmias, "Research Methods in the Social Sciences", New York:

St.Marlia's Press.

5. C. R. Kothari, "Research Methodology: Methods and techniques", New Delhi: Vishwa

Prakashan.

6. Bhattacharya, D. K. (2004) Research Methodology, New Delhi, Excel Books.
7. Brymann, Alan and Carmer, D. (1995) Qualitative data analysis for social scientist, New York, Routledge Publication.

**Discipline Specific Electives for Mechanical Engineering (DSE)**

| Code | Course Name | Credit | L | T | P | CT-1 | CT-II | CT-Total | ESE | G. Total |
|---|---|---|---|---|---|---|---|---|---|---|
| ME-102 | DSE | 5 | 4 | 1 | 0 | 20 | 20 | 40 | 60 | 100 |

**One to be opted**

**ME-102 (1)-FINITE ELEMENT METHOD**

**ME-102 (2)-FRACTURE MECHANICS**

**ME-102 (3)-COMPUTATIONAL FLUID DYNAMICS**

**ME-102 (4)-ADVANCED HEAT & MASS TRANSFER**

**ME-102 (5)-DESIGN AND ANALYSIS OF SOLAR ENERGY SYSTEMS**

**ME-102 (6)-CNC, FMS & CIM**

**ME-102 (7)-ADVANCED MATERIAL SCIENCE AND ENGINEERING**

## ME 102 (i) FINITE ELEMENT METHOD

**Unit-1**

**Introduction and Direct Approach FEM:** Concept of FEM, History, Packages, Range of applications, Steps in FEM, Approaches of FEM, Development of Elemental Equations for simple systems (i) Single dof problems-Spring Network, Hydraulic Network and Resistance Network (ii) Two dof problems- Plane Trusses and Frame structures; Assembly Procedure, Application of Boundary Conditions; Solver Technology: Linear direct solver, Iterative solvers, Eigen solver, Nonlinear equation solver

**Unit-2**

**Galerkin's and Rayleigh-Ritz FEM for 1-D and Radially Symmetric Scalar Field Problems:** Concept of Galerkin's and Raleigh-Ritz Mathematical Approaches, Governing Equation and Boundary Conditions for Heat Transfer-Rod and Fin, Solid Mechanics-Bar extension and Beam bending; Fluid Dynamics-parallel wall flow; Electrostatics and Magnetostatic problems; Weak Formulation and Functional, Polynomial Approximation, Standard 1-D Shape Functions of C0 and C1 Continuity Elements, Derivation of Element Matrices and Vectors, Assembly, Imposition of Boundary Conditions and Nodal Solution; Co-ordinate Transformation and Numerical Integration. Transient and Eigen Value Problems

**Unit-3**

**Galerkin's and Rayleigh-Ritz FEM for Plane (2-D) and Axisymmetric SINGLE VARIABLE**

**Problems:** Governing Equation and Boundary Conditions-Heat Transfer, Solid mechanics-Rod Torsion, Fluid Dynamics-Stream function and Velocity potential formulation, Electrostatics and Magnetostatic Problems, Weak Formulation and Functional, Polynomial Approximation, Standard 2- D Shape Functions of C0 Continuity Elements, Derivation of Element Matrices and Vectors, Assembly, Imposition of Boundary Conditions and Nodal Solution; Mapping and Numerical Integration; Transient and Eigen Value Problems.

**Unit-4**

**Galerkin's and Rayleigh-Ritz FEM for Plane (2-D) and Axisymmetric MULTI VARIABLE Problems:** Governing equation and Boundary conditions- Stress Analysis and Fluid Flow Analysis Problems: Weak Formulation and Functional, Polynomial Approximation, Derivation of Element Matrices and Vectors, Assembly, Imposition of Boundary Conditions and Nodal Solution, Post processing of solutions

**Unit-5**

**Galerkin's and Rayleigh-Ritz FEM for 3-D Problems:** Governing equation and Boundary conditions-Heat Transfer and Elastic Stress Analysis Problems, Weak Formulation and Functional, Polynomial Approximation, Standard 3-D Shape Functions of C0 Continuity Elements, Derivation of Element Matrices and Vectors, Assembly, Imposition of boundary conditions and Nodal Solution; Mapping and Numerical Integration

**References :**


1. Energy and Finite Element Methods in Structural Mechanics: I. H. Shames and C. L. Dym.
2. Concepts and Applications of Finite Element Analysis: R. D. Cook, D. S. Malkus and M. E.
   Plesha.
3. The Finite Element Method Vol. I-II: O.C. Zienkiwicz and R.L. Taylor.
4. Finite Element Procedures: K. J. Bathe.
5. An Introduction to Finite Element Methods: J.N. Reddy.
6. Finite Element Methods in Engineering: S.S. Rao.


## ME 102 (ii) FRACTURE MECHANICS

**Unit-1**

**Introduction:** Modes of loading, Crack growth and fracture mechanisms, Need for fracture mechanics, Linear elastic fracture mechanics and elastic plastic fracture mechanics.

**Energy Release Rate :** Surface Energy, Resistance, Griffith Theory of fracture, Extension of Griffith Theory by Irwin and Orowan, R- Curve, Pop- in phenomena, Crack branching. Necessary and sufficient conditions for fracture.

**Unit-2**

**Crack - Tip Stress and Displacement Fields:** Airy's stress function, Westergaard's approach, Generalized Westergaard's approach, William's Eigen function approach, Multi - parameter stress field equations, Influence of the T- stress and higher order terms, Role of photoelasticity on the development of stress field equations in fracture mechanics.

**Unit-3**

**Stress Intensity Factor:** Equivalence between SIF and G , Various methods for evaluating Stress Intensity Factors.

**Crack Tip Plastic Zone:** Modeling plastic zone at the crack -tip, Irwin and Dugdale models.

**Unit-4**

**Fracture Toughness Testing:** Qualitative toughness testing, KIC testing, K –R curve testing, JIC measurements, J-R curve testing, CTOD testing.

**Micromechanics of Fracture:** Cohesive strength of solids, Cleavage fracture, Intergranular fracture, Ductile fracture, Crack detection methods.

**References:**
1. Elementary Engineering Fracture Mechanics: D. Broek.
2. Elements of Fracture Mechanics: Prashant Kumar.
3. Fracture Mechanics - Fundamentals and Applications: T. L. Anderson.
4. Introduction to Fracture Mechanics: Kare Hellan.
5. Fracture Mechanics- With an Introduction to Micromechanics: Dietmar Gross and
Thomas Seelig.
6. Fracture Mechanics- An Introduction: E.E. Gdoutos.

## ME 102 (iii) COMPUTATIONAL FLUID DYNAMICS

**Unit1-1**

**Basic ideas of CFD:** Introduction to CFD, role of CFD and its applications, future of CFD.

**Governing equations (GE's) of Fluid dynamics***:* Modeling of flow, control volume concept substantial derivative, physical meaning of the divergence of velocity. Continuity equation momentum equation, energy equation and its conservation form. Equations for viscous flow (Navier-Stokes equations), equations for inviscid flow (Euler equation). Different forms o GE's, initial and boundary conditions.

**Unit-2**

**FVM for Diffusion Problems:** FVM for 1D steady state diffusion, 2D steady state diffusion 3d steady state diffusion. Solution of discretised equations- TDMA scheme for 2D and 3D flows.

**FVM for Convection-Diffusion Problems:** FVM for 1D steady state convection-diffusion Central differencing scheme, Conservativeness, Boundedness, Transportiveness, Upwarc differencing scheme, Hybrid differencing scheme for 2D and 3D convection-diffusion Power-law scheme, QUICK scheme.

**Unit-3**

**Solution Algorithm for Pressure-velocity Coupling in Steady Flows:** Concept of staggered grid, SIMPLE, SIMPLER, SIMPLEC, PISO algorithm.

**FVM for Unsteady Flows:** 1D unsteady heat conduction (Explicit, Crank-Nicolson, fully implicit schemes), Implicit mecthods for 2D and 3D problems, Discretization of transien convection-diffusion problems, solution procedure for transient unsteady flow calculation (transient SIMPLE, transient PISO algorithms).

**Unit-4**

**Grid Generation:** General transformation of the equations. Metices and Jacobians. Types o grids- structured and unstructured grids, grid generation methods- algebraic, differential and hybrid methods. Coordinate stretching, boundary-fitted coordinate systems. Elliptic and hyperbolic grid generation methods, orthogonal grid generation for Navier-Stokes equations Multi-block grid generation.

**Latest development in CFD techniques and newer applications.**

**References:**

1. "An Introduction to Computational Fluid Dynamics: the Finite Volume Method", H.K. Versteeg and W. Malalasekara, 2nd edition, Pearson Education, England, 2007.
2. "Computational Fluid Dynamics for Engineers" B. Andersson & others, 1st edition, Cambridge University Press, U.K., 2012.
3. "Computational Fluid Flow and Heat Transfer" (2nd edition), K. Muralidhar and T. Sundararajan, Narosa Publishing, 2004.
4. "Numerical Heat Transfer and Fluid Flow", S.V. Patankar, McGraw-Hill, New York, 1980.
5. "Principles of Computational Fluid Dynamics", P. Wesseling, Springer-Verlag.
6. "Computational Techniques for Fluid Dynamics Volume I & II" (2nd edition), C.A.J. Fletcher, Springer-Verlag, 1991.
7. "Computational Fluid Mechanics and Heat Transfer" (2nd edition), J.C. Tannehill, D.A. Anderson and R.H. Pletcher, Taylor and Francis, 1997.
8. "Numerical Computation of Internal and External Flows" (Vols. I & II), C. Hirsch, Wiley International, 1988.
9. "Computational Fluid Dynamics for Engineers" (Vols. I & II), K. Hoffmann and S. T. Chiang, Engineering Education System, 1993.

## ME 102 (iv) ADVANCED HEAT & MASS TRANSFER

**Unit-1**

General heat conduction equation in Cartesian, cylindrical and spherical co-ordinates –Composite geometries, Variable thermal conductivity, Uniform heat generation-Extended surfaces - Two and three dimensional heat conduction –Numerical and analytical methods. Unsteady heat conduction, Lumped heat systems, Infinite and semi-infinite bodies, Numerical and analytical methods, Periodic variation of surface temperature, Moving boundaries.

**Unit-2**

Convective heat transfer, Boundary layers, Continuity, momentum and energy equations - Boundary layers equations, Dimensional analysis - Exact and approximate solutions to forced convection in laminar and turbulent, internal and external flow, Reynolds and Colburn analogies, forced convection correlations, Solution to free convection problems - Heat transfer at high velocity and incompressible fluid - Liquid metal heat transfer.

**Unit-3**

Radiation heat transfer, Basic laws of radiations, Emissive power, Stefan, Boltzmann, Lambert's, Wien's and Kirchhoff's laws, Emissivity, Radiation intensity - Radiative exchange between black isothermal surfaces, diffuse grey surfaces - Reflecting surfaces, Radiation shape factor - Shape factor algebra, Radiation shields, Combined convective and radiation, Electrical net work analogy solution, Radiosity, Solar radiation, Radiation from gases and vapours.

**Unit-4**

Heat transfer with phase change, Boiling and Condensation, Flow boiling, Correlations. Mass Transfer, Concentration, velocities, Mass fluxes Fick's law, Species, Conservation equation, Steady state molecular diffusion, Equimolar counter diffusion, diffusion through a stagnant gas film, Chemical reaction. Convective mass transfer, Concentration

boundary layer, Momentum, mass and heat transfer analogy, Convective mass transfer numbers, Flow over flat plates, flow through tubes, Correlations, Evaporation of water into air, Heat and mass transfer in separated flows.

**References:**


1. Arpaci, V.S., "Conduction Heat Transfer", Addison Wesley, 1966
2. E.M. Sparrow, R.D. Cess, "Radiative Heat Transfer", McGraw Hill, 1972.
3. Holman. J.P, "Heat Transfer", McGraw Hill.
4. R.C. Sachdeva, "Fundamental of Engineering. Heat and Mass Transfer", New age International, 2003.
5. Bird R.B and J.R. Howell, "Transport Phenomena" Wiley International, 1960.
6. Patrico Oostiuson, "Convective heat and mass Transfer" McGraw Hill
7. Frank P Incropera and David P Dewitt, "Fundamentals of HMT" 6th Edition.


## ME 102 (v) DESIGN AND ANALYSIS OF SOLAR ENERGY SYSTEMS

**Unit-1**

**Design Concepts of Solar Systems:** System conceptual design, Design of components, principles to the solar system based on application. Process includes idea generation, Concepts election and estimation, Design of major components and overall system design, Solar radiation data.

**Unit-2**

**Solar Thermal Energy Storage**: Design aspects of solar thermal energy storage systems, of storage materials for heating and cooling applications, Selection of heat transfer fluid for heating and cooling applications, Design of latent heat thermal energy storage (LHTES) for solar process heating and power generation applications.

**Unit-3**

**Solar Photovoltaic System:** Design of photovoltaic off-grid and grid-connected power systems, Design of system components -PV modules, Batteries, Charge controllers, Inverters, Auxiliaries, analysis of a photovoltaic system, Using software codes for design of solar thermal and photovoltaic systems.

**Unit-4**

**Solar Heating and Cooling Systems:** Design of solar thermal systems for water, Space heating, Cooling and power generation, F-Chart calculation method for sizing solar water and space heating systems, Design of non-focusing and focusing collectors.

**Unit-5**

**Performance Analysis:** Performance analysis of various solar thermal systems, PV system and evaluation of solar thermal energy storage system, Selection of components and materials, Estimation of economics, Using software tools for design of solar thermal and photovoltaic systems, Case studies.

**References:**

1. Solar Energy: Principles of Thermal Collection and Storage by S.P. Sukhatme, J. K. Nayak, Tata McGraw-Hill.
2. Solar Engineering of Thermal Processesby John A. Duffie William A. Beckman, John Wiley & Sons, Inc.
3. Solar Energy Fundamentals and Modeling Techniques, Sen .Z, Turkey.
4. Solar Energy Engineering: Processes and Systems, Kalogirou. S.A, Academic Press.

## ME 102 (vi) CNC, FMS & CIM

**Unit-1**

**Introduction to CNC Machine Tools:** Development of CNC Technology-Principles and classification of CNC machines, Advantages & economic benefits, Types of control, CNC controllers, Characteristics, Interpolators, Applications, DNC concept.

**CNC Programming:** Co-ordinate System, Fundamentals of APT programming, Manual part programming-structure of part programme, G & M Codes, developing simple part programmes, Parametric programming, CAM packages for CNC machines -IDEAS, Unigraphics, Pro Engineer, CATIA, ESPIRIT, Master CAM etc., and use of standard controllers-FANUC, Heidenhain and Sinumeric control system.

**Unit-2**

**Tooling for CNC Machines:** Cutting tool materials, Carbide inserts classification; Qualified, semi-qualified and preset tooling, Cooling fed tooling system, Quick change tooling system, Tooling system for machining centre and turning center, tool holders, Tool assemblies, Tool magazines, ATC mechanisms, Tool management.

**Unit-3**

**Robotics and Material Handling Systems:** Introduction to robotic technology, and applications, Robot anatomy, material handling function, Types of material handling equipment, Conveyer systems, Automated guided vehicle systems, Automated storage/retrieval systems, Work-in-process storage, Interfacing handling and storage with manufacturing.

**Unit-4**

**Group Technology and Flexible Manufacturing System:** group Technology-part families, Parts classification and coding, Production flow analysis, Machine Cell Design, Benefits of Group Technology, Flexible manufacturing systems-Introduction, FMS workstations, Computer control system, Planning for FMS, Applications and benefits.

**Unit-5**

**Computer Integrated Manufacturing:** Introduction, Evaluation of CIM, CIM hardware and software, Requirements of computer to be used in CIM system, Database requirements, Concurrent engineering-Principles, design and development environment, advance modeling techniques.

**References:**

1. “Computer Numerical Control Machines” P. Radahkrishnan, New Central Book Agency, 1992.
2. “CNC Machines”, M.S. Sehrawat and J.S. Narang, Dhanpat Rai and Co., 2014.
3. “CNC Programming Handbook”, Smid Peter, Industrial Press Inc., 2003.

4. “Computer Integrated Manufacturing”, Paul Ranky, Prentice Hall of India, 1999.
5. “CAD/CAM: Computer-Aided Design and Manufacturing”, Groover, Pearson Education India, 2006.

## ME 102 (vii) ADVANCED MATERIAL SCIENCE AND ENGINEERING

**Unit-1**

**Crystal Structure:** Types of bonding, crystal structures of metals and alloys, imperfections in crystals, structure, and properties relationships in engineering materials.

**Equilibrium Diagrams:** Phase rule. Binary equilibrium diagrams, micro-structural changes during cooling; the iron carbon equilibrium diagram; principles and effect of alloying elements on transformation characteristics, Copper-Zinc equilibrium diagram, ternary equilibrium diagrams, experimental determination of equilibrium diagrams.

**Unit-2**

**Phase Changes:** Types of phase changes, diffusion in solids, nucleation and growth kinetics, solidification, T-T-T-diagrams, C-C-T diagrams; effect of heat treatment on properties, precipitation and age hardening; recovery, recrystallization and grain growth.

**Processing of Metals:** Solidification of metals, casting, extrusion, drawing, forging and rolling; powder metallurgy techniques, fabrication through welding, influence of processing and heat treatment on microstructure. quantitative survey of processing.

**Unit-3**

**Engineering Alloys and Applications:** Introduction to steel and alloy specifications; important alloy steels and non-ferrous alloys; cast irons–types, high temperature alloys, light alloys: aluminium and its alloys, copper and its alloys, bearing alloys, shape memory alloy.

**Unit-4**

**Advanced Materials and Materials Engineering:** Smart materials exhibiting ferroelectric, piezoelectric, optoelectric, semiconducting behavior, lasers and optical fibers, photoconductivity and superconductivity, nanomaterials: synthesis, properties and applications; biomaterials, superalloys, shape memory alloys; superhard cutting tool materials and superhard coatings. Ultra light Materials and Metallic Foams: Definition and processing, characterization of cellular metals, properties; various materials and coatings for implants; Coatings and high temperature materials.

**Unit-5**

**Fundamentals of Molecular Self-Assembly:** Nanoscale and colloidal systems, fundamentals of surface and interfacial chemistry, surface tension and wettability, insoluble monolayers, surface chemistry and monolayers, electrostatic interactions in self assembling systems, self-assemble of amphiphiles monolayers, micelles and microemulsions, structure and properties of micelles.

**References:**

1. Material Science for Engineers: An Introduction, W. D. Callister, Jr, John Wily and Sons, Inc.

2. TheScience and Engg.of Materials, Donald R. Askeland, Pradeep P. Fulay, Wendelin J. Wright, Global Engg.
3. Introduction to Physical Metallurgy, Avner S. H., 2nd ed., McGraw Hill.
4. Physical Metallurgy, Raghavan V., Prentice Hall of India.
5. Principles of Thermal Analysis and Calorimetry, Peter J. Haines, Royal Society of Chemistry.
6. Modern Physical Metallurgy and Materials Engineering, R. E. Smallman, R. J. Bishop, Butterworth-Heinemann.
7. Phase Transformations in Metals and Alloys, David A. Porter, Kenneth E. Easterling, 2nd Ed., Nelson Thornes Ltd. (Chapman & Hall).
8. Structure of Metals, Barrett C. S. & Massalski T. B., McGraw Hill, New York.

## RLS-103: Review of Literature and Seminar Presentation

| Code | Course Name | Credit | L | T | P | CT-1 | CT-II | CT-Total | ESE | G. Total |
|---|---|---|---|---|---|---|---|---|---|---|
| RLS103 | Review of Literature and Seminar Presentation | 4 | 0 | 0 | 10 | 20 | 20 | 40 | 60 | 100 |

**Objective-** Main objective of this course is to develop presentation skills in the scholars and knowledge about review of literature so that they can review properly for utilisation in their research work.

**Review of Literature and Seminar** Presentation-Candidate/Research Scholar has to go through the review of literature in the concerned field of research. Review of literature guidelines will be given by the concerned faculty/Dean of Department/School/College. Research Scholar has to prepare presentation on review of literature in the concerned field/ topic assigned by the department (DRC) periodically during course work. There will be minimum 3 presentations of review of literature during pre-Ph.D course work.

- First presentation will be required in DRC/FRC for review of literature with concerned Department focus on area of research. It will be evaluated and assessment sheet will be sent from Department to Dean Research & Studies office.
- Similarly second presentation will be required by research scholar with extension of first presentation and more number of references would be added.

Final presentation would be required at the time of end term/sem examination on proposed synopsis. General guidelines would be issued by Dean-Research for seminar presentation.

For Internal & end semester examination marks will be as per scheme. Each presentation is to be assessed for 10 marks in department.

## RPE-104: Research Publication &Ethics

| Code | Course Name | Credit | L | T | P | CT-1 | CT-II | CT-Total | ESE | G. Total |
|---|---|---|---|---|---|---|---|---|---|---|
| RPE-104 | Research & Publication Ethics | 2 | 2 | 0 | 0 | 20 | 20 | 40 | 60 | 100 |

Course Objective- Its objectiveis to provide knowledge about ethics and code of research publication with concept of plagiarism.

**Theory**

**Unit 1: Philosophy and Ethics (3 hrs)**

1. Introduction to philosophy: definition, nature and scope, concept, branches

2. Ethics: definition, moral philosophy, nature of moral judgements and reactions

**Unit 2: Scientific conduct (5hrs)**

1. Ethics with respect to science and research

2. Intellectual honesty and research integrity

3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP)

4. Redundant publications: duplicate and overlapping publications, salami slicing

5. Selective reporting and misrepresentation of data

**RPE 03: Publication Ethics (7 hrs)**

1. Publication ethics: definition, introduction and importance

2. Best practices/ standards setting initiatives and guidelines: COPE, WAME,etc.

3. Conflicts of interest

4. Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice versa, types

5. Violation of publication ethics, authorship and contributorship

6. Identification of publication misconduct, complaints and appeals

7. Predatory publishers and journals

## Practice

**Open Access Publishing (4 hrs)**

1. Open access publications and initiatives

2. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies

3. Software tool to identify predatory publications developed by SPPU

4. Journal finder/ Journal suggestion tools viz. JANE, Elsevier Journal finder, Springer Journal Suggester, etc.