TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES			
Course Code	**21MAT 31**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives: The goal of the course Transform Calculus, Fourier series and Numerical techniques 21MAT 31 is

- To have an insight into solving ordinary differential equations by using Laplace transform techniques
- Learn to use the Fourier series to represent periodical physical phenomena in engineering analysis.
- To enable the students to study Fourier Transforms and concepts of infinite Fourier Sine and Cosine transforms and to learn the method of solving difference equations by the z-transform method.
- To develop proficiency in solving ordinary and partial differential equations arising in engineering applications, using numerical methods

Teaching-Learning Process (General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students for group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
   - As an introduction to new topics (pre-lecture activity).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post-lecture activity).
   - As a model solution for some exercises (post-lecture activity).

Module-1: Laplace Transform	**(8 Hours)**

Definition and Laplace transforms of elementary functions (statements only). Problems on Laplace's Transform of $e^{at}f(t)$, $t^n f(t)$, $\frac{f(t)}{t}$. Laplace transforms of Periodic functions (statement only) and unit-step function – problems. Inverse Laplace transforms definition and problems, Convolution theorem to find the inverse Laplace transforms (without Proof) problems. Laplace transforms of derivatives, solution of differential equations. **(8 Hours)**

Self-study: Solution of simultaneous first-order differential equations.

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-2: Fourier Series	**(8 Hours)**

Introduction to infinite series, convergence and divergence. Periodic functions, Dirichlet's condition. Fourier series of periodic functions with period 2π and arbitrary period. Half range Fourier series. Practical harmonic analysis.

Self-study: Convergence of series by D'Alembert's Ratio test and, Cauchy's root test.

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-3: Infinite Fourier Transforms and Z-Transforms	**(8 Hours)**

Infinite Fourier transforms definition, Fourier sine and cosine transforms. Inverse Fourier transforms, Inverse Fourier cosine and sine transforms. Problems.

Difference equations, z-transform-definition, Standard z-transforms, Damping and shifting rules, Problems. Inverse z-transform and applications to solve difference equations

Self Study: Initial value and final value theorems, problems.

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-4: Numerical Solution of Partial Differential Equations (8 Hours)

Classifications of second-order partial differential equations, finite difference approximations to derivatives, Solution of Laplace's equation using standard five-point formula. Solution of heat equation by Schmidt explicit formula and Crank-Nicholson method, Solution of the Wave equation. Problems.

Self Study: Solution of Poisson equations using standard five-point formula.

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-5: Numerical Solution of Second-Order ODEs and Calculus of Variations (8 Hours)

Second-order differential equations - Runge-Kutta method and Milne's predictor and corrector method. (No derivations of formulae).

Calculus of Variations: Functionals, Euler's equation, Problems on extremals of functional. Geodesics on a plane, Variational problems

Self Study: Hanging chain problem

(RBT Levels: L1, L2 and L3)

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

1. To solve ordinary differential equations using Laplace transform.
2. Demonstrate the Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
3. To use Fourier transforms to analyze problems involving continuous-time signals and to apply Z-Transform techniques to solve difference equations
4. To solve mathematical models represented by initial or boundary value problems involving partial differential equations
5. Determine the extremals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books:

1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna publishers, 44th Ed.2018
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed. (Reprint), 2016.

Reference Books

1. **V. Ramana:** "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed.
2. **Srimanta Pal & Subodh C. Bhunia:** "Engineering Mathematics" Oxford University Press, 3rd Reprint, 2016.
3. **N.P Bali and Manish Goyal**: "A textbook of Engineering Mathematics" Laxmi Publications, Latest edition.
4. **C. Ray Wylie, Louis C. Barrett:** "Advanced Engineering Mathematics" McGraw – Hill Book Co.Newyork, Latest ed.
5. **Gupta C.B, Sing S.R and Mukesh Kumar:** "Engineering Mathematic for Semester I and II", Mc- Graw Hill Education(India) Pvt. Ltd2015.
6. **H.K.Dass and Er. Rajnish Verma:** "Higher Engineering Mathematics" S.Chand Publication (2014).
7. **James Stewart: "**Calculus" Cengage publications, 7th edition, 4th Reprint 2019.

Web links and Video Lectures (e-Resources):

- http://.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- http://www.bookstreet.in.
- VTU e-Shikshana Program
- VTU EDUSAT Program

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

- Quizzes
- Assignments
  Seminars

FUNDAMENTALS OF AGRICULTURE & CROP PRODUCTION TECHNOLOGY (IPCC)			
Course Code	**21AG32**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8 Lab slots	Total Marks	100
Credits	04	Exam Hours	03

**** Additional one hour may be considered for Instructions if required***

Course objectives:

- Imparting knowledge on different crops, crop nutrition and growth
- Describing crop-water relations in association to crop growth and development
- Illustrating crop management, cropping pattern and weed management
- Imparting the fundamentals of crop production technology of crops
- Providing knowledge on the importance and practices followed in growing crops

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for Problem Solving.
3. Arrange visits to show the live working models other than laboratory topics.
4. Adopt collaborative (Group Learning) Learning in the class.
5. Adopt Problem Based Learning (PBL), which fosters students Analytical skills and develops thinking skills such as evaluating, generalizing, and analysing information.
6. Conduct Laboratory Demonstrations and Practical Experiments to enhance experiential skills.

MODULE-1 **8 HOURS**

Agronomy, its definition, scope and role of Agronomist. Tillage-objectives of tillage, types of tillage, tillage implements and factors affecting tillage, Effect of tillage on soil and crop growth. Tilth: its definition, characteristics and ideal tilth, Modern concepts of tillage, minimum, zero and stubble mulch tillage, importance of puddling. Conventional tillage practices and their effects, modern tillage practices and their advantages; optimum tillage with different tillage implements and their effect on soil properties.

Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments

MODULE- 2 **8 HOURS**

Seed, its definition, characteristics of quality seed, seed treatment and its objectives. Seed dormancy, causes of seed dormancy and multiplication, stages of seed. Methods of sowing seed and sowing implements. Effect of plant population on growth and yield, Planting geometry viz., solid, paired and skipped row planting.

Importance of manures and fertilizers and its classification. Methods and time of application of manures, fertilizers and green manuring. Nutrient use efficiency and factors affecting nutrient use efficiency.

Scheduling of Irrigation and Fertilizers: Irrigation schedules for different crops in different soils and agro-climatic regions, fertigations, irrigation methods. Plant Protection Measures- Pesticides, types of weedicides and insecticides available to control different weed flora, pests and diseases and their mode of action; time of application and symptoms.

Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments

MODULE-3 **8 HOURS**

Weeds, its definition, characteristics of weeds, merits and demerits of weeds, classification of weeds, meaning of crop weed competition and its period in different crops. Principles and methods of weed management viz., cultural, mechanical, chemical, biological weed control methods and integrated weed management. Classification of herbicides, its selectivity and resistance, Allelopathic effect of weed. Crop harvesting, signs of maturity in different field crops, Physiological and crop maturity, Method of harvesting	
Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments
MODULE-4	**8 HOURS**
Introduction: Concepts in crop production; geographical distribution of crops and cropping systems; economic importance. Crop Classification: Cereals, pulses, oilseeds, fiber crops, forage crops, medicinal and aromatic crops and horticultural crops. **Cropping Systems for Major Agro-Ecological Regions:** Detailed descriptions of rice based cropping systems, sugarcane based cropping systems, cotton based cropping systems, pulses and oilseeds based cropping systems, their suitability in different agro-ecological regions. Crop rotation, its definition, principles and advantages of crop rotation. Study of crop adaptation and its distribution. Growth and development, its definition, growth curve and factors affecting growth and development.	
Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments
MODULE-5	**8 HOURS**
Crop Eco Systems: Irrigated and rain fed eco systems, strategies of crop production in tropical and sub- tropical regions in the two major eco systems under different crops. Modern Techniques of Raising Field and Horticultural Crops Techniques of nursery raising, method of planting, fertilization, irrigation scheduling, weed control, and other practices to optimize yield, economic evaluations. **Crop Growth Assessment**: Crop, growth parameters and their measurements.	
Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments

PRACTICAL COMPONENT OF IPCC *(May cover all / major modules)*

Sl.NO	**Experiments**
1	Identification of crops, seeds, fertilizers, pesticides & Tillage implements
2	Effect of sowing depth on germination and seedling vigour
3	Study of yield contributing characters and yield estimation
4	Seed germination and viability test
5	Numerical exercises on fertilizer requirement
6	Plant Population and water requirement
7	Use of tillage implements (reversible plough, one way plough, harrow, leveller, seed drill)
8	Study of soil moisture measuring devices
9	Measurement of field capacity, bulk density and infiltration rate
10	Measurement of irrigation water
11	Study of crop varieties and agronomic experiments at experimental farm
12	Morphological description of Kharif season crops (rice).

Course outcomes (Course Skill Set):

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

- Express knowledge gained on the principles of agronomy

- Recognize the various nutrients and their effects on plant health
- Plan irrigation measures for plant growth and development
- Manage weeds in a field
- Plan for sustainable agricultural production
- Apply scientific methods and tools in field preparation and for designing cropping
- Comprehend the fundamentals of crop production of cereals
- Decide on the crops, fertilizers and irrigation measures for production of pulses
- Plan for sustainable crop production of oilseeds
- Explain the techniques involved in crop production of fibre and forage crops
- Correlate parameters involved in crop cultivation and practices of crop cultivation

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The**15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks**.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

3. The question paper will have ten questions. Each question is set for 20 marks.
4. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
5. The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the

theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.

- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Books

1. Crop production and field experimentation by V.G. Vaidya, K.R. Sahastrabudhe and V.S. Khuspe. Continental Prakashan, Vijaynagar, Pune.
2. Hand book of Agriculture, ICAR Publication.
3. Modern techniques of raising field corps by Chidda Singh. Oxford and IBH Publishing Co. Ltd., Bangalore.
4. Principles of Agronomy by Sankaran S. and V.T. SubbiahMudliyar, 1991. The Bangalore Printing and Publishing Co. Ltd., Bangalore.
5. Agronomy by S.C. Panda, 2006. Agribios Publication, New Delhi.
6. Crop Production and Management by Y.B. Moranchan. Oxford and IBH Publishing Co. Ltd., Bangalore.
7. Principles of Agronomy by S.R. Reddy, Kalyani Publishers, Ludhiana, India.
8. Principles of Crop Production by Martin J.H. and Leonard W.H. the Mac Million Company, New York – 1962.
9. Scientific Crop Production (Vol. I and II). Thakur C. Metropolitan Books Co. Pvt. Ltd., New Delhi.
10. Fundamentals of Agronomy. Gopal Chandra De. 1980. Oxford and IBH Publishing Co. Ltd., Bangalore
11. Singh, Chidda "Modem technique of raising of field crops". Oxford and IBH Publishing Company Pvt. Ltd., 1994.
12. Suresh Singh Tomar, YagyaDev Mishra and Shailendra Singh Kushah. 2018. Production Technology of Rabi Crops. Biotech books, New Delhi, India.
13. Rajendra Prasad. 2017. Textbook of field crops production, Volume 1 and 2 (Foodgrain crops & Commercial Crops). ICAR, India.
14. ingh, R.P., Reddy, P.S. and Kiresur, V.(eds.). "Efficient Management of Dryland Crops in India". Indian Society of Oilseed Research, DOR Rajendra Nagar, Hyderabad, 1997.
15. Joshi M. 2015. Textbook of Field Crops. Prentice Hall India Learning Private Limited, India.

Web links and Video Lectures (e-Resources):

https://www.youtube.com/watch?v=AnnZFYXnlfw

https://www.youtube.com/watch?v=8ulpy_GFLDk

https://www.youtube.com/watch?v=NCp93xbSwWM

https://www.youtube.com/watch?v=60qVUwLP1s8

https://www.ipcc.ch/site/assets/uploads/2018/02/ar4-wg3-chapter8-1.pdf

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

- Quizzes
- Assignments
- Seminars
- Mini Projects

Course Code	**21AG33**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 12-15 Lab slots	Total Marks	100
Credits	04	Exam Hours	03
**** Additional one hour may be considered for Instructions if required***			

Course objectives:

- Appreciate basic concepts of soil mechanics as an integral part
- Comprehend basic engineering and mechanical properties of different types of soil.
- Model and measure strength-deformation characteristics of soils
- Familiar with Soil mechanics problems such as flow though soils
- Study about assessing stability of slopes and earth pressure on rigid retaining structures
- Understand the basic principles of Surveying
- Learn Linear and Angular measurements to arrive at solutions to basic surveying problems.
- Employ conventional surveying data capturing techniques and process the data for computations.
- Analyze the obtained spatial data to compute areas and volumes and draw contours to represent 3D data on plane figures.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for Problem Solving.
3. Arrange visits to show the live working models other than laboratory topics.
4. Adopt collaborative (Group Learning) Learning in the class.
5. Adopt Problem Based Learning (PBL), which fosters students Analytical skills and develops thinking skills such as evaluating, generalizing, and analyzing information.

Conduct Laboratory Demonstrations and Practical Experiments to enhance experiential skills

MODULE-1	**8 HOURS**
Engineering Properties of Soils-Water content; Unit weight of soil; Specific gravity; Void ratio; Porosity; Degree of saturation; Functional relationships; Determination of index properties; Liquid limit; Plastic limit; Shrinkage limit; Plasticity index; Particle size distribution curve. Classification of Soils and Clay Mineralogy-Particle size classification; Textural classification; Indian standards classification; Soil structure; **Soil Hydraulics**-Modes of occurrence of water in soils; Stress condition in soil; Permeability; Factors affecting permeability; Laboratory and field methods of determining permeability coefficients. **Well Hydraulics**; Definitions; Dupuits theory; Pumping out test; Pumping in test; Interference among wells; Seepage analysis; 2-dimensional flow; Flow nets Elasticity Applied to Soils-State of stress at a point; Equilibrium equations; Strain components; Stress distribution; Pressure distribution diagrams; Newmark's influence charts; Contact pressure; Principal stresses and maximum shear. Compression and Compressibility ,Vertical sand drain; Compaction; Field compaction methods and controls.	
Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments
MODULE-2	**8 HOURS**

Strength and Stability-Shear strength; Mohr circle of stresses; Measurement of shear strength; direct shear tests; Tri-axial compression test; Unconfined compression test; vane shear test; Pore pressure parameters; Active and passive earth pressures; Stability of slopes; Taylors stability number and stability curves; Bearing Capacity of Soil; Rankine analysis; Terzaghi analysis; General and local shear failure;Mayerhoeff's analysis; Effect of water table on bearing capacity;. Stabilization of Soil and Site Investigation-Introduction; Method of Stabilisation; Site exploration; Depth of exploration; Methods ofsite exploration; Soil samples and samplers.	
Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments
MODULE-3	**8 HOURS**
INTRODUCTION: Overview of plane surveying (chain, compass and plane table), Objectives, Principles and classifications. Distance measurement conventional symbols and methods; use of chain and tape, Electronic distance measurements, Meridians, Azimuths and Bearings, declination, computation of angle. LEVELING AND CONTOURING: Concept and Terminology, Temporary and permanent adjustments method of leveling. Contouring: Contours, Methods of contouring, Interpolation of contours, contour gradient, characteristics of contours and uses.	
Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments
MODULE-4	**8 HOURS**
COMPUTATION OF AREAS AND VOLUMES: Area from field notes, computation of areas along irregular boundaries and area consisting of regular boundaries. Embankments and cutting for a level section and two level sections with and without transverse slopes, determination of the capacity of reservoir, volume of barrow pits. THEODOLITE & TACHEOMETRIC SURVEYING Theodolite, description, uses and adjustments – temporary and permanent, measurement of horizontal and vertical angles. Principles of Electronic Theodolite. Trigonometrical leveling, Traversing. Stadia and tangential methods of Tacheometry.	
Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments
MODULE 5	**8 HOURS**
INDTRODUCTION TO ADVANCED SURVEYING: Introduction to geodetic surveying, Total Station and Global positioning system, Introduction to Geographic information system (GIS) & Modern Instruments and its applications. Modern Surveying Instruments Introduction, Electromagnetic spectrum, Electromagnetic distance measurement, Total station, Lidar scanners for topographical survey. Aerial Photogrammetry Introduction, Uses, Aerial photographs, Definitions, Scale of vertical and tilted photograph (simple problems), Ground Co-ordinates (simple problems), Relief Displacements (Derivation).	
Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments

PRACTICAL COMPONENT OF IPCC *(May cover all / major modules)*

Sl.NO	Experiments
1	Special gravity of soil solids
2	Grain size distribution
3	Atterberg Limits
4	Field density Test (Sand replacement method)
5	Permeability determination (constant head and falling head methods)
6	Direct shear test in cohesion-less soil
7	Unconfined compression test in cohesive soil
8	a) Measurements of distances using tape along with horizontal planes and slopes, direct ranging. b) Setting out perpendiculars. Use of cross staff, optical square.
9	Measurements of bearings / directions using prismatic compass, setting of geometrical figures using prismatic compass.
10	Determination of reduced levels of points using dumpy level/auto level (differential leveling and inverted leveling).
11	To conduct profile leveling, cross sectioning and block leveling. Plotting profile and cross sectioning in excel. Block contour on graph paper to scale.
12	Measurement of horizontal angle by repetition and reiteration methods
13	Determination of horizontal distance to a base in accessible object using theodolite by single plane and double plane method.
14	To determine distance and elevation using tachometric surveying with horizontal and inclined line of sight.
15	Demonstration of Minor instruments like Clinometer, Ceylon Ghat Tracer, Box sextant, hand Level, Digital Planimeter and Pentagraph

Course outcomes (Course Skill Set):

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

- Acquire an understanding of the procedures to determine properties of any type of soil, classify the soil based on its index properties.
- Able to determine permeability property of soils and acquires conceptual knowledge about stresses due to seepage and effective stress.
- Able to estimate seepage losses across hydraulic structures.
- Able to estimate shear strength parameters of different types of soils using
- the data of different shear tests and comprehend Mohr-Coulomb failure theory
- Ability to solve practical problems related to bearing capacity
- Able to plan and execute geotechnical site investigations for Hydraulic structures
- Possess a sound knowledge of fundamental principles Geodetics
- Measurement of vertical and horizontal plane, linear and angular dimensions to arrive at solutions to basic surveying problems.
- Capture geodetic data to process and perform analysis for survey problems]
- Analyse the obtained spatial data and compute areas and volumes. Represent 3D data on plane figures as contours.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The**15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks**.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Books

1. Soil Mechanics and Foundation Engineering Murthy, V.N.S UBS Publishers and Distributors, New Delhi. 1996
2. Soil Mechanics and Foundation Punmia, B.C New Delhi STD Book House, 1987 2017
3. Basic and Applied Soil Mechanics Gopalrajan and Rao, A.S.R. New Age International (P) Ltd., New delhi. 2000
4. Soil Mechanics T.W. Lambe and R.V. Whitman John Wiley & Sons. 1969
5. Geotechnical Engineering Donald P Coduto Phi Learning Private Limited, New Delhi.
6. Surveying (Vol – 1, 2 & 3) B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain Laxmi Publications (P) ltd., New Delhi
7. Surveying (Vol – 1 & 2) Duggal S K Tata Mc-Graw Hill Publishing Co. Ltd New Delhi 2004
8. Elements of Plane Surveying Arthur R Benton and Philip J Taety McGraw Hill 2000
9. Surveying Vol 1, 2 & 3 Arora K R Standard Book House, Delhi, 2004

Web links and Video Lectures (e-Resources):

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

- Quizzes
- Assignments
- Seminars
- Mini Projects

MECHANICS OF MATERIALS AND MACHINES			
Course Code	**21AG34**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3-0-0-0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- To learn about simple stresses and strains and their applications.
- To learn how to find shear force and bending moment and construction of SFD & BMD
- To understand the concept of machines, mechanisms and to analyze a mechanism for displacement, velocity and acceleration at any point in a moving link.
- To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms
- To understand the theory of gears and gear trains.
- To enable the students to understand the general procedure for designing any machine parts.

Teaching-Learning Process (General Instructions)

These are sample strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for Problem Solving.
3. Adopt flipped classroom teaching method.
4. Adopt collaborative (Group Learning) learning in the class.
5. Adopt Problem Based Learning (PBL), which fosters students' analytical skills and develops thinking skills such as evaluating, generalizing, and analysing information.

Module-1

Simple Stresses and Strains: Elasticity and plasticity – Types of stresses and strains – Hooke's law – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them

Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board

Module-2

Shear Force and Bending Moments: Types of supports – Types of beams – Shear force and bending moment diagrams for simply supported - Cantilever and over hanging beams with point loads, uniformly distributed load, uniformly varying loads and couples – Relationship between shear force and bending moment.

Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board

Module-3

Introduction: Mechanisms and machines, Kinematic pairs-types, degree of freedom, Kinematic chains and their classification, Kinematic inversions,

Velocity and Acceleration analysis of planar mechanisms Graphical method: Velocity and Acceleration Analysis of Mechanisms Velocity and acceleration analysis of four bar mechanism, slider crank mechanism.

Velocity and Acceleration Analysis of Mechanisms (Analytical Method): Velocity and acceleration analysis of four bar mechanism, slider crank mechanism using complex algebra method.

Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board

Module-4

Static force analysis: Static equilibrium, analysis of four bar mechanism, slider crank mechanism, shaper mechanism. **Dynamic force analysis**: D'Alembert's principle, analysis of four bar and slider crank mechanism, shaper mechanism. **Flywheel:** Introduction to Flywheel and calculation of its size for simple machines like punching machine, shearing machine **Spur Gears**: Gear terminology, law of gearing, path of contact, arc of contact, contact ratio of spur gear.. **Gear Trains**: Simple gear trains, compound gear trains. Epicyclic gear trains.	
Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board
Module-5	
MACHINE DESIGN – Definition, Classification of machine design, General considerations in machine design, General procedure in machine design. Fundamental units, Mass and Weight, inertia, laws of motion, force, moment of force, couple mass density, torque, work, power and energy. **LEVERS** – Introduction, application of levers in engineering practice, design of lever hand levers, foot lever, and cranked lever. Springs – Introduction, types of springs, material for helical springs, spring wire, terminology	
Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board

Course outcome (Course Skill Set)

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

1. The students would be able to understand the behaviour of materials under different stress and strain conditions.
2. Knowledge of mechanisms and their motion and the inversions of mechanisms
3. Analyse the mechanisms for static and dynamic equilibrium.
4. Carry out the balancing of rotating and reciprocating masses
5. Analyse different types of governors used in real life situation.
6. Various basic terms related to machine design aspect

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

Books

1. R.S. Khurmi, Theory of Machines, Khanna Publishers, 2003.
2. S. S. Ratan, Theory of Machines, Tata McGraw Hill, 2nd Edition, 2005
3. Ghosh A. and Mallick A.K, Theory of Mechanisms and Machines, Affiliated East-West Press, 2nd Edition, 1988.
4. Thomas Bevan, Theory of Machines, CBS Publishers, 3rd Edition, 1984
5. J.S Rao. & R.V Dukkipati, Mechanism and Machine Theory, Newagepublishers, 2nd edition 1992

Web links and Video Lectures (e-Resources):

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

- Quizzes
- Assignments
- Seminars

BASIC WORKSHOP PRACTICE LAB			
Course Code	**21AGL35**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(0:0:2:0)	SEE Marks	50
Credits	01	Exam Hours	03

Course objectives:

- To identify tools, work material and measuring instruments useful for fitting, carpentry, Sheet metal working and Smithy practice
- To handle tools and instruments and use them to prepare joints of specific shape and size

Sl.NO	Experiments
1.	**Fitting:** Introduction, Various tools used in fitting shop- Holding tools; Marking and Measuring tools; Striking tools; Cutting tools; finishing tools
2.	Preparation of Square fitting model in fitting shop
3.	Preparation of V fitting model in fitting shop
4.	**Carpentry:** Introduction, Timber, classification and characteristics; Various tools used in carpentry shop- Holding tools; Marking and Measuring tools; Striking tools; Planing tools; Cutting tools – saws and chisels
5.	Preparation of T-Lap joint model in Carpentry shop
6.	Preparation of Dove-tail Lap joint model in Carpentry shop
7.	**Sheet metal working:** Introduction, Sheet metals used in metal work; Various tools used- Holding tools; Marking and Measuring tools; Striking tool – hammers and mallets; Snips; Stakes
8.	Preparation of Open scoop model in Sheet metal shop
9.	Preparation of Rectangular tray model in Sheet metal shop
10.	**Smithy:** Introduction, Principle of forging; Various tools used- Holding tools; Marking and Measuring tools; Striking tool – hammers; Flatters; Swage block; V-Block; Tongs, etc
11.	To prepare S-Hook from a given round rod
12.	To make a square rod from a given round rod.

Course outcomes (Course Skill Set):

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

1. To select suitable tools and equipment to prepare joints using bench-work tools.
2. To produce joints using materials of specific shape and size by a suitable PO1,PO3, PO5, PSO1, set of operations and check the accuracy of shape and dimensions using suitable measuring tools.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8^{th} week of the semester and the second test shall be conducted after the 14^{th} week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

Text Books

1. 1. Elements of Mechanical Engineering - Hajra Choudhury & others, Media Promoters 2010.
2. 2. The Elements of Workshop Technology - Vol I & II, S.K. Hajra Choudhury, A.K. Hajra Choudhury, Nirjhar Roy, 11th edition 2001 others, Media Promoters and Publishers, Mumbai.

Introduction to PYTHON (AEC-III)			
Course Code	21AG381	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	25	Exam Hours	2

Course objectives:

- Statistical tests. The course provides hands-on training in usage of basic concepts, control structures, data structures, object oriented programming, exceptional handling and plotting of graphical entities.

Sl.NO	Experiments
1	Implement the following tasks a) Write a python program to check whether the number is positive or negative. b) Write a python program to find whether a given number is even or odd. c) Write a python program to find biggest number among three numbers.
2	Implement the following tasks a)Write a python program to displaying reversal of a number. b) Write a python program to print factorial of a number c) Write a python program to generate prime numbers series up to N
3	Implement following problems using python script a) Swapping of two number with and without using temporary variable. b) If the age of Ram, Sam, and Khan are input through the keyboard, write a python program to determine the eldest and youngest of the three. c) Arithmetic operations (Addition, Subtraction, Multiplication, and Division) on integers. Input the two integer values and operator for performing arithmetic operation through keyboard.
4	Implement the following tasks a) Implement the python program to generate the multiplication table. b) Implement Python program to find sum of natural numbers c) If the first name of a student is input through the keyboard, write a program to display the vowels and consonants present in his/her name.
5	Implement the following tasks a) The marks obtained by a student in 5 different subjects are input through the keyboard. Find the average and print the student grade as per the SIETK examination policy. b) Given a number x, determine whether it is Armstrong number or not. Hint: For example, 371 is an Armstrong number since 3**3 + 7**3 + 1**3 = 371. Write a program to find all Armstrong number in the range of 0 and 999.
6	Implement the following tasks a) Write a Python script to • create a list • access elements from a list • slice lists • change or add elements to a list • delete or remove elements from a list b) Write a Python script to read the values from a list and to display largest and smallest numbers from list. c) Write a Python script to compute the similarity between two lists.
7	Implement the following tasks a) Write a Python script to read set of values from a Tuple to perform various operations. b) Write a Python script to perform basic dictionary operations like insert, delete and Display. c) Write a Python program to count the occurrence of each word in a given sentence.
8	Implement the following tasks a) Write a Python script to create Telephone Directory using dictionary and list to perform basic functions such as Add entry, Search, Delete entry, Update entry, View and Exit. b) Implement Python script to display power of given numbers using function. c) Implement a Python program that takes a list of words and returns the length of the longest one using function.
	Demonstration Experiments (For CIE)
9	Implement the following tasks a) Implement Python program to perform various operations on string using string libraries. b) Implement Python program to remove punctuations from a given string.

	c) Write a Python program to change the case of the given string (convert the string fromlower case to upper case). If the entered string is —computer‖, your program should output—COMPUTER‖ without using library functions.
10	Implement the following tasks a)Implement Python program to capitalize each word in a string. For example, the entered sentence —god helps only people who work hard‖ to be converted as —God Helps Only People Who Work Hard‖ e) Write a Python script to display file contents. f) Write a Python script to copy file contents from one file to another.
11	Implement the following tasks a) Write a Python script to combine two text files contents and print the number of lines, sentences, words, characters and file size. b) Write a Python commands to perform the following directory operations. • List Directories and Files • Making a New Directory • Renaming a Directory or a File • Removing Directory or File
12	Implement the following tasks a) Create a package named Cars and build three modules in it namely, BMW, Audi and Nissan. Illustrate the modules using class. Finally we create the init .pyfile. This file will be placed inside Cars directory and can be left blank or we can put the initialization code into it. b) Write a python script to display following shapes using turtle. 

Course outcomes (Course Skill Set):

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

- Ability to program on basic concepts, controlstructures.
- Ability to implement data structures and their operations
- Ability to work on object oriented programming
- Ability to handle exceptional handling and plotting of graphical entities.
- Ability to develop any real world problem

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination(SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.
SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University
All laboratory experiments are to be included for practical examination.
(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.
Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.
The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

1. VamsiKurama, Python Programming: A Modern Approach, Pearson
2. ReemaThareja, Python Programming - Using Problem Solving Approach, First Edition (English, Paperback), Oxford University Press.
3. Mark Lutz, Learning Python,Orielly
4. Allen Downey, Think Python, Green Tea Press
5. W.Chun, Core Python Programming, Pearson.
6. Kenneth A. Lambert, Introduction to Python,Cengage
7. Michael T. Goodrich , Roberto Tamassia, Michael H. Goldwasser, Data Structures and Algorithms in Python, 1st Edition , kindle Edition .

SENSORS & ACTUATORS (AEC-III)			
Course Code	**21AG382**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	16	Total Marks	100
Credits	01	Exam Hours	01

Course objectives:

- To provide the fundamental knowledge about sensors and measurement system.
- To impart the knowledge of static and dynamic characteristics of instruments and understand the factors in selection of instruments for measurement.
- To discuss the principle, design and working of transducers for the measurement of physical time varying quantities.
- To Understand the working of various actuators suitable in industrial process control systems

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) needs not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.

5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyse information rather than simply recall it

Module-1	
Sensors and measurement system: Sensors and transducers, Classifications of transducers-primary & secondary, active & passive, analog and digital transducers. Smart sensors. **Measurement:** Definition, significance of measurement, instruments and measurement systems. Mechanical, electrical and electronic instruments.	
Teaching-Learning Process	Chalk and board, Active Learning, Demonstration
Module-2	
Static and Dynamic Characteristics: Static calibration and error calibration curve, accuracy and precision, indications of precision, static error, scale range and scale span, factors influencing the choice of transducers/instruments. Dynamic response – Dynamic characteristics, natural frequency and Damping ratio.	
Teaching-Learning Process	Chalk and board, Active Learning, Demonstration
Module-3	
Measurement of Temperature: RTD, Thermistor, Thermocouple, Thermopile, AD590. **Measurement of Displacement:** Introduction, Principles of Transduction, Variable resistance devices, variable Inductance Transducer, Variable Capacitance Transducer	
Teaching-Learning Process	Chalk and board, Active Learning, Demonstration
Module-4	
Measurement of Strain: Introduction, Types of Strain Gauges, Theory of operation of resistance strain gauges, Applications. **Measurement of Force & Torque:** Introduction, Force measuring sensor –Load cells, Hydraulic load cell, electronic weighing system**.** Torque measurement	
Teaching-Learning Process	Chalk and board, Active Learning, Demonstration
Module-5	
Actuators and process control system: Introduction. Block diagram and description of process control system with an example, Actuators, Control elements. **Electrical actuating systems:** Solid-state switches, Solenoids **Pneumatic Actuators, Hydraulic Actuators**	
Teaching-Learning Process	Chalk and board, Active Learning, Demonstration

Course outcome (Course Skill Set)

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

- Understand the fundamental concepts of sensors and actuator system.(L2)
- Describe the principle and working of different types of sensors and actuators used in industrial application.(L2)
- Illustrate the applications of different transducers for temperature, displacement, level, strain, force and torque measurements

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Three Tests (preferably in MCQ pattern with 20 questions) each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

1. First assignment at the end of 4th week of the semester
2. Second assignment at the end of 9th week of the semester

Quiz/Group discussion/Seminar, any two of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

The sum of total marks of three tests, two assignments, and quiz /seminar/ group discussion will be out of 100 marks and shall be **scaled down to 50 marks**

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure minimum of 35% of the maximum marks meant for SEE.

Suggested Learning Resources:

Textbook

1. Electrical and Electronic Measurements and Instrumentation, A K Sawhney, 17th Edition, (Reprint 2004), Dhanpat Rai & Co. Pvt. Ltd., 2004.

2. Instrumentation: Devices and Systems, C S Rangan, G R Sarma, V S V Mani, 2nd Edition (32 Reprint), McGraw Hill Education (India), 2014.

3. Process Control Instrumentation Technology by C D Johnson, 7th Edition, Pearson Education Private Limited, New Delhi 2002.

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc21_ee32/preview
- https://archive.nptel.ac.in/courses/108/108/108108147/
- https://www.youtube.com/watch?v=HMNYf1QQ83U

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

- A small project to use sensors to study home activities.
- Design Smart Digital School Bell with Timetable Display.
- Design contactless water level controller.

Semester 03

FUNDAMENTALS OF VIRTUAL REALITY			
Course Code	**21AG383**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:2:0:0	SEE Marks	50
Total Hours of Pedagogy	30	Total Marks	100
Credits	01	Exam Hours	01

Course objectives:

- Describe how VR systems work and list the applications of VR.
- Understand the design and implementation of the hardware that enables VR systems to be built.
- Understand the system of human vision and its implication on perception and rendering.
- Explain the concepts of motion and tracking in VR systems.
- Describe the importance of interaction and audio in VR systems.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

- Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
- Chalk and Talk method for Problem Solving.
- Adopt flipped classroom teaching method.

- Adopt collaborative (Group Learning) learning in the class.
- Adopt Problem Based Learning (PBL), which fosters students' analytical skills and develops thinking skills such as evaluating, generalizing, and analysing information.

Module-1	
Introduction to Virtual Reality : Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality.	
Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board
Module-2	
Representing the Virtual World : Representation of the Virtual World, Visual Representation in VR, Aural Representation in VR and Haptic Representation in VR	
Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board
Module-3	
The Geometry of Virtual Worlds &The Physiology of Human Vision: Geometric Models, Changing Position and Orientation, Axis-Angle Representations of Rotation, Viewing Transformations, Chaining the Transformations, Human Eye, eye movements & implications for VR.	
Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board
Module-4	
Visual Perception & Rendering : Visual Perception - Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates	
Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board
Module-5	
Motion & Tracking : Motion in Real and Virtual Worlds- Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection Tracking- Tracking 2D & 3D Orientation, Tracking Position and Orientation, Tracking Attached Bodies	
Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board

Course outcome (Course Skill Set)

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

CO1: Describe how VR systems work and list the applications of VR.

CO2: Understand the design and implementation of the hardware that enables VR systems to be built.

CO3: Understand the system of human vision and its implication on perception and rendering.

CO4: Explain the concepts of motion and tracking in VR systems.

CO5: Describe the importance of interaction and audio in VR systems.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Three Tests (preferably in MCQ pattern with 20 questions) each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

1. First assignment at the end of 4th week of the semester
2. Second assignment at the end of 9th week of the semester

Quiz/Group discussion/Seminar, any two of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

The sum of total marks of three tests, two assignments, and quiz /seminar/ group discussion will be out of 100 marks and shall be **scaled down to 50 marks**

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure minimum of 35% of the maximum marks meant for SEE.

Suggested Learning Resources:

Books

1. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016
2. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002
3. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009.

Reference Books:

1. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.
2. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces, Theory and Practice", Addison Wesley, USA, 2005.
3. Oliver Bimber and Ramesh Raskar, "Spatial Augmented Reality: Meging Real and Virtual Worlds", 2005.
4. Burdea, Grigore C and Philippe Coiffet, "Virtual Reality Technology", Wiley Interscience, India, 2003.

Web links and Video Lectures (e-Resources):

http://lavalle.pl/vr/book.html
https://nptel.ac.in/courses/106/106/106106138/
https://www.coursera.org/learn/introduction-virtual-reality.

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

(For Agriculture Engineering & Allied branches) **Choice Based Credit System (CBCS) and Outcome-Based Education (OBE)** SEMESTER - IV			
Complex Analysis, Probability and Linear Programming			
Course Code	**21MAT41**	CIE Marks	50
Teaching Hours/Week (L: T:P)	(2:2:0)	SEE Marks	50
Credits	03	Exam Hours	03

Course Learning Objectives:

- To provide an insight into applications of complex variables and conformal mapping arising in potential theory, quantum mechanics, heat conduction and field theory.
- To develop probability distribution of discrete, continuous random variables and joint probability distribution occurring in digital signal processing, design engineering and microwave engineering.
- Analyze and solve linear programming models of real-life situations and learn about the applications to transportation and assignment problems.

Teaching-Learning Process (General Instructions):

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

7. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied mathematical skills.
8. State the need for Mathematics with Engineering Studies and Provide real-life examples.
9. Support and guide the students for self–study.
10. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
11. Encourage the students for group learning to improve their creative and analytical skills.

Show short related video lectures in the following ways

- As an introduction to new topics (pre-lecture activity).
- As a revision of topics (post-lecture activity).
- As additional examples (post-lecture activity).
- As an additional material of challenging topics (pre-and post-lecture activity).

As a model solution for some exercises (post-lecture activity).

Module-1

Calculus of complex functions: Analytic functions: Cauchy-Riemann equations in Cartesian and polar forms and consequences. Applications to flow problems

Construction of analytic functions: Milne-Thomson method-Problems. (**8 hours)**

Self-Study: Review of a function of a complex variable, limits, continuity, and differentiability.

(RBT Levels: L1, L2 and L3)

Pedagogy: Chalk and talk method and Powerpoint Presentations

Module-2

Conformal transformations: Introduction. Discussion of transformations

$w = z^2$, $w = e^z$, $w = z + \frac{1}{z}, (z \neq 0)$. Bilinear transformations- Problems.

Complex integration: Line integral of a complex function-Cauchy's theorem and Cauchy's integral formula and problems. (**8 hours)**

Self-Study: Residues, Residue theorem – problems

(RBT Levels: L1, L2 and L3)

Pedagogy: Chalk and talk method and Powerpoint Presentations

Module-3

Probability Distributions: Review of basic probability theory. Random variables (discrete and continuous), probability mass/density functions. Mean-Variance and Standard Deviations of a random variable. Binomial, Poisson, exponential and normal distributions- problems. **(8 hours)**

Self-Study: Two-dimensional random variables, marginals pdf's, Independent random variables

(RBT Levels: L1, L2 and L3)

Pedagogy: Chalk and talk method and Powerpoint Presentations

Module-4

Linear Programming Problems (L.P.P): General Linear programming Problem, Canonical and standard forms of L.P.P. Basic solution, Basic feasible solution, Optimal solution, Simplex Method-Problems. Artificial variables, Big-M method, Two-Phase method-Problems. **(8 hours)**

Self-Study: Formulation of an L.P.P and optimal solution by Graphical Method.

(RBT Levels: L1, L2 and L3)

Pedagogy: Chalk and talk method and Powerpoint Presentations

Module-5

Transportation and Assignment Problems: Formulation of transportation problems, Methods of finding initial basic feasible solutions by North-West corner method, Least cost method, Vogel approximation method. Optimal solutions-Problems. Formulation of assignment problems, Hungarian method-Problems. **(8 hours)**

Self-Study: Degeneracy in Transportation problem.

(RBT Levels: L1, L2 and L3)

Pedagogy: Chalk and talk method and Powerpoint Presentations

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

- Use the concepts of an analytic function and complex potentials to solve the problems arising in fluid flow.
- Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing.
- Apply discrete and continuous probability distributions in analyzing the probability models arising in the engineering field.
- Analyze and solve linear programming models of real-life situations and solve LPP by the simplex method
- Learn techniques to solve Transportation and Assignment problems.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

First test at the end of 5th week of the semester

Second test at the end of the 10th week of the semester

Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

First assignment at the end of 4th week of the semester

Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

The question paper will have ten questions. Each question is set for 20 marks.

There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books:

3. B. S. Grewal: "Higher Engineering Mathematics", Khanna publishers, 44th Ed.2018
4. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons,10th Ed. (Reprint),2016.
5. S.D. Sharma: "Operations Research" Kedarnath Publishers Ed. 2012

Reference Books

8. V. Ramana: "*Higher Engineering Mathematics*" McGraw-Hill Education,11th Ed.
9. Mokhtar S.Bazaraa, John J.Jarvis & Hanif D.Sherali(2010*), Linear Programming and Network Flows(* 4th E*dition), John Wiley & sons.*
10. G.Hadley (2002) *Linear Programming, Narosa Publishing House*
11. F.S. Hillier. G.J. Lieberman: Introduction to Operations Research- Concepts and Cases, 9th Edition, Tata Mc-Graw Hill, 2010.
12. Srimanta Pal & Subodh C. Bhunia: "Engineering Mathematics" Oxford University Press,3rdReprint, 2016.
13. N.P Bali and Manish Goyal: "A textbook of Engineering Mathematics" Laxmi Publications, Latest edition.
14. C. Ray Wylie, Louis C. Barrett: "Advanced Engineering Mathematics" McGraw – Hill Book Co. New York, Latest ed.
15. H.K. Dass and Er. RajnishVerma:"Higher EngineeringMathematics"S.ChandPublication(2014).

Web links and Video Lectures (e-Resources):

- http://.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- https://www.coursera.org/learn/operations-research-modeling
- https://www.careers360.com/university/indian-institute-of-technology-madras/introduction-operations-research-certification-course
- http://people.whitman.edu/~hundledr/courses/M339.html
- VTU e-Shikshana Program
- VTU EDUSAT Program

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

- Quizzes
- Assignments
- Seminars

TRACTOR & AUTOMOTIVE ENGINES (IPCC)			
Course Code	**21AG42**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(3:0:2:0)	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 12 Lab slots	Total Marks	100
Credits	04	Exam Hours	03

Course Objectives:

- The objective of this subject is to impart the knowledge of tractor engine components, working principles of IC engines, auxiliary systems, the combustion aspects of SI and CI engines in addition to the methods of improving performance.
- The students shall become aware on the latest developments in the field of IC engines like MPFI, CRDI etc. The student also shall apply the thermodynamic concepts in IC engines.
- Basic understanding of fuel properties and its measurements using various types of measuring devices
- Energy conversion principles, analysis and understanding of I C Engines will be discussed.
- Application of these concepts for these machines will be demonstrated. Performance analysis will be carried out using characteristic curves.
- Exhaust emissions of I C Engines will be measured and compared with the standards.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for Problem Solving.
3. Arrange visits to show the live working models other than laboratory topics.
4. Adopt collaborative (Group Learning) Learning in the class.
5. Adopt Problem Based Learning (PBL), which fosters students Analytical skills and develops thinking skills such as evaluating, generalizing, and analyzing information.

Module-1	**8 HOURS**
Study of sources of farm power –conventional & non-conventional energy sources. Classification of tractors and IC engines. Review of thermodynamic principles of IC (CI & SI) engines and deviation from ideal cycle. General energy equation and heat balance sheet. Study of mechanical, thermal and volumetric efficiencies. Study of engine components their construction, operating principles and functions. Study of engine strokes and comparison of 2-stroke and 4-stroke engine cycles and CI and SI engines.	
Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations
Module-2	**8 HOURS**
Study of Engine Valve systems, valve mechanism, Valve timing diagram and valve clearance adjustment, Study of Cam profile, valve lift and valve opening area. Study of importance of air cleaning system. Study of types of air cleaners and performance characteristics of various air cleaners.	
Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations
Module-3	**8 HOURS**
Study of fuel supply system. Study of fuels, properties of fuels, calculation of air-fuel ratio. Study of tests on fuel for SI and CI engines. Study of detonation and knocking in IC engines. Study of carburetion system, carburetors and their main functional components. **Study of fuel injection system** – Injection pump, their types, working principles. Fuel injector nozzles – their types and working principle. Engine governing – need of governors and governor types.	
Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations
Module-4	**8 HOURS**
Study of lubrication system – need, types, functional components. Study of lubricants – physical properties, additives and their application. Engine cooling system – need, cooling methods and main functional components. Study of need and type of thermostat valves. Additives in the coolant. Study of radiator efficiency.	
Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations

Module-5	**8 HOURS**
Study of ignition system of SI engines. Study of electrical system including battery, starting motor, battery charging, cut-out, etc. Comparison of dynamo and alternator. Familiarization with the basics of engine testing.	
Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations

PRACTICAL COMPONENT OF IPCC *(May cover all / major modules)*

Sl.NO	**Experiments**
1	Study of I.C. Engine parts and functions
2	Study of Working principle of Four stroke and Two stroke cycle I.C. Engine
3	Study of valve system and valve timing diagram
4	Determination of engine power
5	Study of Oil & Fuel system - determination of physical properties
6	Study of Air cleaning system
7	Study of Diesel injection system & timing
8	Study of Cooling system
9	Demonstration of working of governing system
10	Demonstration of working of Lubricating system
11	Demonstration of working of electrical and ignition system
12	Determination of Tractor engine heat balance and engine performance curves
13	Visit to engine manufacturer/ assembler/ spare parts agency**. (Optional)**

Course outcomes (Course Skill Set):

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

- Understand, discuss and describe the fundamentals and working of IC engine
- Apply their knowledge and identify the working mechanism of different components of IC engine.
- Analyse the problems in using right amount of fuel and lubricants for better efficiency and economy
- Evaluate and understand the heat engine balance of engine for maintaining at right temperature for different type of work
- Apply and understand ignition system and problems faced during starting of ignition system
- Apply and understand governing system and problems faced during running of governing system
- Perform experiments to determine the properties of fuels and oils.
- Conduct experiments on engines and draw characteristics.
- Test basic performance parameters of I.C. Engine and implement the knowledge in industry
- Identify exhaust emission, factors affecting them and exhibit his competency towards preventive maintenance of IC Engine

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester

- Second assignment at the end of 9th week of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The**15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks**.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

. The question paper will have ten questions. Each question is set for 20 marks.

5. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
6. The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Books

10. Donnel Hunt. Farm Power Machinery and management. Iowa State University Press, Ames, USA.
11. Gill Paul, W., Smith James, H., and Ziurys Eugene, J. (1967). Fundamentals of Internal Combustion Engines. Oxford & IBE Publishing Company, New Delhi.
12. Gupta, R.B., and Gupta, B.K. (1987). Tractor Mechanic, Theory, Maintenance and Repair. Sathya Prakashan and Tech India Publications, New Delhi.
13. Jain, S.C., and Rai, C.R. (1984). Farm Tractor - Maintenance and Repair. Tata Mc Graw- Hill Publishing Company Ltd, New Delhi.
14. Liljedahl John, B., Casleton Walter, M., Turnquist Paul, K., and Smith David, W. (1951). Tractors and Their Power Units, . John Wiley & Sons, New-York.
15. Mathur, M.L., and Sharma, R.P. (1994). A Course in Internal Combustion Engines. Danpat Rai & Sons, Delhi.
16. Gill Paul, W., Smith James, H., and Ziurys Eugene, J. (1967). Fundamentals of Internal Combustion Engines. Oxford & IBE Publishing Company, New Delhi.
17. Gupta, R.B., and Gupta, B.K. (1987). Tractor Mechanic, Theory, Maintenance and Repair. Sathya Prakashan and Tech India Publications, New Delhi.
18. Jain, S.C., and Rai, C.R. (1984). Farm Tractor - Maintenance and Repair. Tata Mc Graw- Hill Publishing Company Ltd, New Delhi.

19. Jagdishwar Sahay. 2015. Elements of Agricultural Engineering. Standard Publishers, New Delhi
20. Nakra C.P., 2009. Farm Machines and Equipments. Dhanpat Rai Publishers, New Delhi
21. Jain SC and CR Rai., 2008. Farm Tractor Maintenance and Repair. Standard Publishers, New Delhi
22. Neil Southorn, Tractors, 1995. Operation, Performance and Maintenance, Inkata Press Australia.

Web links and Video Lectures (e-Resources):

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

- Quizzes
- Assignments
- Seminars
- Mini Projects

AGRICULTURAL PROCESS ENGINEERING (IPCC)			
Course Code	**21AG43**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(3:0:2:0)	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 12 Lab slots	Total Marks	100
Credits	04	Exam Hours	03

Course Objectives:

- To train the students on unit operations of agricultural process engineering
- To acquaint with the engineering properties of agricultural materials
- Enable the students to understand the concepts of cleaning of cereals, size reduction and rice milling

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for Problem Solving.
3. Arrange visits to show the live working models other than laboratory topics.
4. Adopt collaborative (Group Learning) Learning in the class.
5. Adopt Problem Based Learning (PBL), which fosters students Analytical skills and develops thinking skills such as evaluating, generalizing, and analyzing information.
6. Conduct Laboratory Demonstrations and Practical Experiments to enhance experiential skills.

Module-1	**8 HOURS**
Physical characteristics of different food grains: fruits and vegetables – importance, Shape and size – criteria for describing shape and size, Roundness and sphericity – Volume and density – Specific gravity – Bulk density Porosity – surface area. **Rheology** – basic concepts, ASTM standard definition of terms, Rheological Properties – Force deformation behavior, stress and strain behavior, Visco elasticity – time effects, Friction – basic concepts, effect of load sliding velocity, Rheological models - Kelvin and Maxwell models, electrical equivalence of mechanical models, Rheological equations – Generalized Maxwell and Kelvin models	
Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments
Module-2	**8 HOURS**
Frictional Properties: Friction in agricultural materials – measurement – rolling resistance – angle of internal friction and angle of repose, Aerodynamics of agricultural products – drag coefficient – frictional drag and profit drag or pressure drag and terminal velocity. Electrical properties – Di electrical properties, Thermal Properties – specific heat – thermal conductivity-thermal diffusivity, Application of engineering properties in handling and processing equipment and also storage structures.	
Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments
Module-3	**8 HOURS**
Theory of separation: Types of separators, Cyclone separators, Size of screens applications, Separator based on length, width and shape of the grains, specific gravity, density, Air-screen grain cleaner principle and types, Design considerations of air screen grain cleaners, Sieve analysis-particle size determination, Ideal screen and actual screen– effectiveness of separation and related problems, Pneumatic separator, Cleaning and separation equipment's.	
Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments
Module-4	**8 HOURS**
Scope and importance of crop processing: Principles and methods of food processing- cleaning and grading of cereals, Size reduction –principle of comminution/ size reduction, mechanisms of comminution of food, particle shape, average particle size, Characteristics of comminuted products, crushing efficiency, Determination and designation of the fineness of ground material, screen analysis, Empirical relationships (Rittinger_s, Kick_s and Bond_s equations), Work index, energy	

utilization, Methods of operating crushers, Classification based on particle size, Nature of the material to be crushed, Size reduction equipment – Principal types, crushers (jaw crushers, gyratory, smooth roll), Hammer mills, Attrition mills, Burr mill, Tumbling mills, Action in tumbling mills, Size reduction equipment –Ultra fine grinders (classification hammer mills, colloid mill), Cutting machines (slicing, dicing, shredding, pulping), Energy requirement of size deduction	
Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments
Module-5	**8 HOURS**
Rice milling: Principles and equipments, Paddy parboiling methods and equipment, Wheat milling, Milling of Pulses and Oilseeds, Theory of filtration, Rate of filtration, Pressure drop during filtration, Applications, Constant rate filtration and Constant–pressure filtration derivation of equation, Filtration equipment, Plate and frame filter press, Rotary filters, Centrifugal filters and Air filters	
Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments

PRACTICAL COMPONENT OF IPCC *(May cover all / major modules)*

Sl.NO	Experiments
1	Preparation of flow charts and layout of a food processing plant
2	Mixing index and study of mixers
3	Determination of fineness modulus and uniformity index
4	Determination of mixing index of a feed mixer
5	Determination of the efficiency of cyclone separator
6	Tutorial on extraction by McCabe and Thiele plot
7	Tutorial on use of psychometric chart
8	Tutorial Problems on distillation
9	Tutorial on power requirement in size reduction of grain using Ratzinger's law, Kicks law and Bond's law
10	Performance evaluation of hammer mill and attribution mill.
11	Separation behaviour in pneumatic separation
12	Evaluation of performance of indented cylinder

Course outcomes (Course Skill Set):

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

- Be proficient in the scope of the process engineering and the use of processing machinery
- Understand the physical properties, rheological properties and frictional properties of agricultural materials
- Summarising the thermal properties, electrical properties and the terms related to the machine design aspects
- Some of the basic concepts related to cleaning and size reduction equipments
- To acquaint the students with the milling of rice, parboiling technologies and milling of pulses and oil seeds
- Understand the filtration equipments

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The**15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks**.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Books

1. Post Harvest Technology of Cereals, Pulses and oil seeds, Chakraverty A 1988. Oxford and IBH Publishing Co. Ltd., Calcutta.
2. Unit Operations of Agricultural Processing, Sahay KM and Singh KK 1994, Vikas Publishing House Pvt. Ltd., New Delhi
3. Unit Operations of Chemical Engineering, McCabe WL, Smith JC and Harriott P 2017 McGraw-Hill Book Co., Boston.
4. Transport Processes and separation Process Principle, Geankoplis C J 2015 Prentice-Hall Inc., New Jersey.
5. Unit operations in Food processing, Earle R L 1983. Pergamon Press, New York
6. file:///C:/Users/DELL/Downloads/AlabmanualonAgriculturalProcessingandStructures.pdf
7. Post Harvest Technology of Cereals, Pulses and oil seeds, Chakraverty A 1988. Oxford and IBH Publishing Co. Ltd., Calcutta.
8. Unit Operations of Agricultural Processing, Sahay KM and Singh KK 1994, Vikas Publishing House Pvt. Ltd., New Delhi.

Web links and Video Lectures (e-Resources):
Activity Based Learning (Suggested Activities in Class)/ Practical Based learning • Quizzes • Assignments • Seminars • Mini Projects

THERMODYNAMICS & FLUID MECHANICS			
Course Code	**21AG43**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:

The course will enable the students to

- Acquire a basic understanding of properties of fluids and the measurement of pressure and fluid kinematics.
- Acquire a basic understanding of fundamentals fluid dynamics, and Benoulli's equation and flow meters.
- Acquire the basic concepts of flow through pipes and losses in pipe flows.
- Understand the basic concepts of flow over bodies and usefulness of dimensionless analysis.
- Acquire the fundamentals of compressible flow and the basic knowledge of working of CFD packages.
- Acquire the knowledge of simple fluid mechanics experimental setups and carry out the necessary analysis of these experiments
- Acquire knowledge experimental errors and the ability to estimate the experimental uncertainties.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Adopt different type of teaching methods to develop the outcomes through Power-Point Presentation and Video demonstration or Simulations.
2. Chalk and Talk method for Problem Solving.
3. Arrange visits to show the live working models other than laboratory topics.
4. Adopt collaborative (Group Learning) Learning in the class.
5. Adopt Problem Based Learning (PBL), which fosters students Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information.
6. Conduct Laboratory Demonstrations and Practical Experiments to enhance experiential skills.

MODULE-1

Basic Concepts: Definitions of system, boundary, surrounding control volume. Types of thermodynamic systems, Properties of system, definitions for properties like pressure, volume, temperature, enthalpy, internal energy, density, with their units. State, Property, Process and Cycle, Quasi Static Process, Thermodynamic Equilibrium.

Work & Heat Transfer: Work transfer, Types of work transfers, Point and Path Functions, Heat transfer, Comparison of Work and Heat transfers.

Zeroth Law of Thermodynamics: Zeroth Law of Thermodynamics. Heat and temperature - concept of thermal equilibrium

Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving. 4. Laboratory Demonstrations and Practical Experiments

MODULE-2

First Law of Thermodynamics: First law of thermodynamics- simple problems on heat and work conversions in process and cycle. Non flow energy equation (NFEE). Limitations of First law of thermodynamics.

Second Law of Thermodynamics: Heat Engine, Statements of Second law and their equivalence, Refrigeration and Heat Pump, Reversibility and Irreversibility, availability and unavailability – concept of change in entropy.

Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving. 4. Laboratory Demonstrations and Practical Experiments

MODULE-3

Introduction: Definition and properties, types of fluids, pressure at a point in static fluid, variation of pressure, Pascals Law, (To be reviewed in class but not for examination)

Pressure- absolute, gauge, vacuum, pressure measurement by manometers and gauges, hydrostatic pressure on plane submerged bodies. Buoyance and metacentre, Stability of submerged bodies

Fluid Kinematics: Velocity of fluid particle, types of fluid flow, streamlines, pathlines and streaklines continuity equation, acceleration of fluid particle, strain rate, vorticity, stream function, potential function, Circulation, Reynolds transport theorem.

Fluid Dynamics: Introduction, Forces acting on fluid in motion, Linear momentum equation, Impact of jets, Moment of momentum equation, Euler's equation of motion along a streamline, Bernoulli's equation – assumptions and limitations. Introduction to Navier Stokes equation, Venturimenters, orificemeters, rectangular and triangular notches, pitot tubes, Rota meter, electromagnetic flow meter	
Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving. 4. Laboratory Demonstrations and Practical Experiments
MODULE-4	
Laminar and Turbulent flow: Flow through circular pipe, between parallel plates, Power absorbed in viscous flow in bearings, Poiseuille equation Loss of head due to friction in pipes, Major and minor losses, pipes in series and parallel. Flow over bodies: Development of boundary layer, Lift and Drag, Flow around circular cylinders, spheres, aerofoils and flat plates, Streamlined and bluff bodies, boundary layer separation and its control.	
Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving. 4. Laboratory Demonstrations and Practical Experiments
MODULE 5	
Dimensional Analysis: Derived quantities, dimensions of physical quantities, dimensional homogeneity, Rayleigh method, Buckingham Pi-theorem, dimensionless numbers, similitude, types of similitude.Compressible flows: Speed of sound, adiabatic and isentropic steady flow, Isentropic flow with area change stagnation and sonic properties, normal and oblique shocks, flow through nozzles. Introduction to CFD: Necessity, limitations, philosophy behind CFD, applications	
Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving. 4. Laboratory Demonstrations and Practical Experiments

Course outcomes (Course Skill Set):

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

- Understand the basic principles of fluid mechanics and fluid kinematics
- Acquire the basic knowledge of fluid dynamics and flow measuring instruments
- Understand the nature of flow and flow over bodies and the dimensionless analysis
- Acquire the compressible flow fundamental and basics of CFD packages and the need for CFD analysis.
- Conduct basic experiments of fluid mechanics and understand the experimental uncertainties.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

7. First test at the end of 5th week of the semester
8. Second test at the end of the 10th week of the semester
9. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

10. First assignment at the end of 4th week of the semester
11. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

12. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

3. The question paper will have ten questions. Each question is set for 20 marks.
4. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

Reference Books

1. Fox, R. W., Pitchard,P. J.,and McDonald, A. T., (2010), Introduction to Fluid Mechanics, 7thEdition, John Wiley & Sons Inc.
2. Cimbala, J.M., Cengel, Y. A. (2010),Fluid Mechanics: Fundamentals and Applications, McGraw-Hill
3. Frank M White., (2016), Fluid Mechanics, 8thEdition , McGraw-Hill

Additional References:

1. A text book of Fluid Mechanics and Hydraulic Machines, Dr. R K Bansal, Laxmi publishers
2. Fundamentals of Fluid Mechanics, Munson, Young, Okiishi & Hebsch, John Wiley Publicationss, 7th Edition

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-me22/
2. https://ocw.mit.edu/search/ocwsearch.htm?q=fluid%20mechanics
3. https://directory.doabooks.org/discover?query=Fluid+Mechanics&locale-attribute=en
4. http://elearning.vtu.ac.in/econtent/courses/video/CV/10CV35.html

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

- Quizzes
- Assignments
- Seminars

MACHINE DRAWING AND GD & T			
Course Code	21AGL46	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2*:0	SEE Marks	50
Credits	01	Exam Hours	03
* One additional hour may be considered wherever required			

Course objectives:

- To acquire the knowledge of limits, tolerance and fits and indicate them on machine drawings.
- To make drawings using orthographic projections and sectional views
- To impart knowledge of thread forms, fasteners, keys, joints, couplings and clutches.
- To understand and interpret drawings of machine components leading to preparation of assembly drawings manually and using CAD packages.

Module 1 (only for CIE) 01 Sessions

Review of basic concepts of Engineering Visualization

Geometrical Dimensioning and Tolerances (GD&T): Introduction, Fundamental tolerances, Deviations, Methods of placing limit dimensions, machining symbols, types of fits with symbols and applications, geometrical tolerances on drawings. Standards followed in industry.

Module 2 (only for CIE) 02 Sessions

Sections of Simple and hollow solids: True shape of sections.

Module 3 (only for CIE) 03 Sessions

Thread Forms: Thread terminology, sectional views of threads. ISO Metric (Internal & External), BSW (Internal & External) square and Acme. Sellers thread, American Standard thread, Helicoil thread inserts

Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly), simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, countersunk head screw, grub screw, Allen screw

Rivets

Keys: Parallel key, Taper key, Feather key, Gib-head key and Woodruff key.

Module 4 03 Sessions

Assembly of Joints, couplings and clutches (with GD&T) using 2D environment

Joints: Like Cotter joint (socket and spigot), knuckle joint (pin joint).

Couplings: Like flanged coupling, universal coupling

Clutches: Like Single Plate clutch, cone clutches

Module 5 05 Sessions

Assembly of Machine Components (with GD&T) using 3D environment

(Part drawings shall be given)

1. **Bearings**
2. **Valves**
3. **Safety Valves**
4. **I.C. Engine components**
5. **Lifting devices**
6. **Machine tool components**
7. **Pumps**

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:
CO1: Interpret the Machining and surface finish symbols on the component drawings.
CO2: Apply limits and tolerances to assemblies and choose appropriate fits for given assemblies.
CO3: Illustrate various machine components through drawings
CO4: Create assembly drawings as per the conventions.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks) and that for SEE minimum passing mark is 35% of the maximum marks (18 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

- CIE shall be evaluated for max marks 100. Marks obtained shall be accounted for CIE final marks, reducing it by 50%.
- CIE component should comprise of
    - Continuous evaluation of Drawing work of students as and when the Modules are covered.
    - At least one closed book **Test** covering all the modules on the basis of below detailed weightage.
    - ***Weightage for Test and Continuous evaluation shall be suitably decided by respective course coordinators***.

Module	**Max. Marks Weightage**	**Evaluation Weightage in marks**	
		Computer display & printout	**Preparatory sketching**
Module 1	10	05	05
Module 2	15	10	05
Module 3	25	20	05
Module 4	25	20	05
Module 5	25	25	00
Total	**100**	**80**	**20**

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

- The duration of SEE is 03 hours**. Questions shall be set worth of 3 hours**
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University.
- SEE shall be conducted and evaluated for maximum marks 100. Marks obtained shall be accounted for SEE final marks, reducing it to 50 marks.
- Question paper shall be set jointly by both examiners and made available for each batch as per schedule. **Questions are to be set preferably from Text Books.**
- Evaluation shall be carried jointly by both the examiners.
- Scheme of Evaluation: *To be defined by the examiners jointly and the same shall be submitted to the university along with question paper.*

- One full question shall be set from Modules 3 and 4 as per the below tabled weightage details. ***However, the student may be awarded full marks, if he/she completes solution on computer display without sketch***.

Module	**Max. Marks Weightage**	**Evaluation Weightage in marks**	
		Computer display & printout	**Preparatory sketching**
Module 4	40	30	10
Module 5	60	50	10
Total	**100**	**80**	**20**

Suggested Learning Resources:

Books:

- K L Narayana, P Kannaiah, K Venkata Reddy, "Machine Drawing", New Age International, 3rd Edition. ISBN-13: 978-81-224-2518-5, 2006
- N D Bhatt , "Machine Drawing", Charotar Publishing House Pvt. Ltd.,50th Edition, ISBN-13: 978-9385039232, 2014

Reference Books:

- Sadhu Singh, P. L. Sah, "Fundamentals of Machine Drawing", PHI Learning Pvt. Ltd, 2nd Edition, ISBN: 9788120346796, 2012
- Ajeet Singh, "MACHINE DRAWING", Tata McGraw-Hill Education, , ISBN: 9781259084607, 2012

INTRODUCTION TO INTERNET OF THINGS (AEC-IV)			
Course Code	**21AG481**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(0:2:0:0)	SEE Marks	50
Total Hours of Pedagogy	25	Total Marks	100
Credits	01	Exam Hours	02

Course Objectives:

- To understand the basics of Internet of things
- To design IoT applications in different domain and be able to analyze their performance.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for Problem Solving.
3. Arrange visits to show the live working models other than laboratory topics.
4. Adopt collaborative (Group Learning) Learning in the class.
5. Adopt Problem Based Learning (PBL), which fosters students Analytical skills and develops thinking skills such as evaluating, generalizing, and analyzing information.
6. Conduct Laboratory Demonstrations and Practical Experiments to enhance experiential skills.

Module-1

Overview of IOT : Introduction to IoT, Defining IoT, Characteristics of IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs

Introduction to IOT Network Architecture : IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture

Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments

Module-2

Telemetry : IoT& M2M Machine to Machine, Difference between IoT and M2M, Software define Network

Smart Objects : The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies

Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments

Module-3

IOT Network Protocols: IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.

Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general)

	3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments
Module-4	
Security in IOT : Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IOT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment	
Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments
Module-5	
IoT Physical Devices and Endpoints: Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - Raspberry-Pi: Introduction to Raspberry-Pi, About the Raspberry-Pi Board: Hardware Layout, Operating Systems on Raspberry-Pi, Configuring Raspberry-Pi, Programming Raspberry-Pi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to Raspberry-Pi	
Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments

Course outcome (Course Skill Set)

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

1. Explain the concepts of Internet of Things and network Architecture
2. Compare and contrast the deployment of smart objects and the technologies to connect them to network.
3. Analyze basic protocols in wireless sensor network
4. Elaborate the need of Security in IOT
5. Design IOT applications in different domain and be able to analyse their performance

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Three Tests (preferably in MCQ pattern with 20 questions) each of **20 Marks (duration 01 hour**)

4. First test at the end of 5th week of the semester
5. Second test at the end of the 10th week of the semester
6. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

3. First assignment at the end of 4th week of the semester
4. Second assignment at the end of 9th week of the semester

Quiz/Group discussion/Seminar, any two of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

The sum of total marks of three tests, two assignments, and quiz /seminar/ group discussion will be out of 100 marks and shall be **scaled down to 50 marks**

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure minimum of 35% of the maximum marks meant for SEE.

Suggested Learning Resources:

Books

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)
2. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach"
3. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1stEdition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)
4. Srinivasa K G, "Internet of Things", CENGAGE Leaning India,2017

Web links and Video Lectures (e-Resources):

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

- Quizzes
- Assignments
- Seminars

HUMAN ENGINEERING AND SAFETY (AEC-IV)			
Course Code	**21AG482**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(1:0:0:0)	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	01

Course Objectives:

- To acquaint and equip with the ergonomic aspects in the design of farm machinery and equipment and safety aspects of human subjects.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for Problem Solving.
3. Arrange visits to show the live working models other than laboratory topics.
4. Adopt collaborative (Group Learning) Learning in the class.
5. Adopt Problem Based Learning (PBL), which fosters students Analytical skills and develops thinking skills such as evaluating, generalizing, and analyzing information.
6. Conduct Laboratory Demonstrations and Practical Experiments to enhance experiential skills.

Module-1

Human factors: Human factors in system development – concept of systems. Basic processes in system development, performance reliability, human performance. Information input process.

Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments

Module-2

Displays: Visual displays, major types and use of displays, auditory and tactual displays. Speech communications

Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments

Module-3

Biomechanics: Biomechanics of motion, types of movements, Range of movements, strength and endurance, speed and accuracy, human control of systems. Human motor activities, controls, tools and related devices.

Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments

Module-4

Anthropometry and Atmospheric conditions : Anthropometry - arrangement and utilization of work space, atmospheric conditions, heat exchange process and performance, air pollution.

Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments

Module-5

Safety regulations: Dangerous machine (Regulation) act, Rehabilitation and compensation to accident victims, Safety gadgets for spraying, threshing, Chaff cutting, Power tiller and tractor & trailer operation etc.

Teaching-Learning Process	1. PowerPoint Presentation 2. Chalk and Talk are used for Problem Solving (In-general) 3. Video demonstration or Simulations 4. Laboratory Demonstrations and Practical Experiments

Course outcome (Course Skill Set)

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

1. Equip with the ergonomic aspects in the design of farm machinery and equipment
2. Equip with the safety aspects of human subjects.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Three Tests (preferably in MCQ pattern with 20 questions) each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

1. First assignment at the end of 4th week of the semester
2. Second assignment at the end of 9th week of the semester

Quiz/Group discussion/Seminar, any two of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

The sum of total marks of three tests, two assignments, and quiz /seminar/ group discussion will be out of 100 marks and shall be **scaled down to 50 marks**

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure minimum of 35% of the maximum marks meant for SEE.

Suggested Learning Resources:

Books

16. Bridger, R.S. Introduction to ergonomics, 1995. McGraw Hill, INC, New York.
17. Charles D Reese. Accident / incident prevention techniques, 2001. Taylor and Francis, London.
18. Gavrielsalvendy,. Hand book of human factors and ergonomics,1997. John Wileyand sons, INC, New York.
19. Kromer, K.H.E. Ergonomics, 2001. Prentice hall, Upper saddle river, NJ 07458.
20. William D. McArdle. Exercise physiology, 1991. LEA andFEBIGER, London.

Web links and Video Lectures (e-Resources):

- http://www.osha.gov/SLTC/ergonomics
- http://www.ergonomicsusa.com
- http://www.masterytech.com/productpage.php?product_id=clmimsdt
- http://www.samaras-assoc.com/ergonomics.htm
- http://www.ergonomics4schools.com/lzone/anthropometry.htm
- http://www.brianmac.co.uk/biomechanics.htm
- http://www.d.umn.edu/~mlevy/CLASSES/.../esat3300_intro.htm
- http://www.websters-dictionary-online.org/wo/work+physiology.html
- http://www.ufv.ca/faculty/kpe/.../physiology%203r/workphysio3.ppt
- http://www.chiroweb.com/archives/18/07/06.html
- http://www.brianmac.co.uk/oxdebit.htm
- http://www.osha.gov/SLTC/heatstress
- http://www.plantstress.com/Articles/heat_i/heat_i.htm
- http://www.hoptechno.com/book41.htm
- http://www.tuolumnejpa.org/Cold%20Stress.pdf
- http://www.ginmiller.com/gmf06/articles/.../RPE_talk_test.html
- http://www.cdc.gov/physicalactivity/everyone/.../exertion.html
- http://www.laxpart161.com/en/noise_effects_LAX.pdf
- http://www.asha.org/public/hearing/disorders/noise.htm
- http://www.managementparadise.com/forums/...php/t-17709.html
- http://www.hkv.com/applications/.../humanvibration.aspx

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

- Quizzes
- Assignments
- Seminars
- Mini Projects

Semester 04 **Ability Enhancement Course IV**

SPREAD SHEETS FOR ENGINEERS			
Course Code	21AG483	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	1	Exam Hours	03

Course objectives:

- To create different plots and charts
- To compute different functions, conditional functions and make regression analysis
- To carryout iterative solutions for roots, multiple roots, optimization and non-linear regression analysis
- To carryout matrix operations
- To Understand VBA and UDF
- To understand VBA subroutines and Macros
- To carryout numerical integration and solving differential equations using different methods

Sl.NO	**Experiments**
1	**Charting:** Create an XY scatter graph, XY chart with two Y-Axes, add error bars to your plot, create a combination chart
2	**Functions:** Computing Sum, Average, Count, Max and Min, Computing Weighted Average, Trigonometric Functions, Exponential Functions, Using The CONVERT Function to Convert Units
3	**Conditional Functions:** Logical Expressions, Boolean Functions, IF Function, Creating a Quadratic Equation Solver, Table VLOOKUP Function, AND, OR and XOR functions.
4	**Regression Analysis:** Trendline, Slope and Intercept, Interpolation and Forecast, The LINEST Function, Multilinear Regression, Polynomial Fit Functions, Residuals Plot, Slope and Tangent, Analysis ToolPack.
5	**Iterative Solutions Using Excel:** Using Goal Seek in Excel, Using The Solver To Find Roots, Finding Multiple Roots, Optimization Using The Solver, Minimization Analysis, NonLinear Regression Analysis.
6	**Matrix Operations Using Excel:** Adding Two Matrices, Multiplying a Matrix by a Scalar, Multiplying Two Matrices, Transposing a Matrix, Inverting a Matrix and Solving System of Linear Equations.
7	**VBA User-Defined Functions (UDF):** The Visual Basic Editor (VBE), The IF Structure, The Select Case Structure, The For Next Structure, The Do Loop Structure, Declaring Variables and Data Types, An Array Function The Excel Object Model, For Each Next Structure.
8	**VBA Subroutines or Macros:** Recording a Macro, Coding a Macro Finding Roots by Bisection, Using Arrays, Adding a Control and Creating User Forms.
	Demonstration Exercises
9	**Numerical Integration Using Excel:** The Rectangle Rule, The Trapezoid Rule, The Simpson's Rule, Creating a User-Defined Function Using the Simpson's Rule. .
10	
11	**Differential Equations:** Euler's Method, Modified Euler's Method, The Runge Kutta Method, Solving a Second Order Differential Equation
12	

Course outcomes (Course Skill Set):

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

- To create different plots and charts
- To compute different functions, conditional functions and make regression analysis
- To carryout iterative solutions for roots, multiple roots, optimization and non-linear regression analysis
- To carryout matrix operations
- To Understand VBA and UDF
- To understand VBA subroutines and Macros
- To carryout numerical integration and solving differential equations using different methods

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination(SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

- McFedries Paul Microsoft Excel 2019 Formulas And Functions Microsoft Press, U.S, 2019 Edition
- E. Joseph Bill0, Excel@ for Scientists and Engineers Numerical Methods, WILEY-INTERSCIENCE A John Wiley & Sons, Inc., Publication, 2007
- **https://onlinelibrary.wiley.com/doi/pdf/10.1002/0471461296.app4**