Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Curriculum for

Final Year B. Tech

2017 Pattern

(Mechanical Engineering)

Department of

Mechanical Engineering

VISION

Excellence in Mechanical Engineering for Global Acceptance

MISSION

- Make spirited mechanical engineers with morals, values and principles for sustainable development of society.
- Strive continuously to impart knowledge and skills of the highest standards.
- Our engineers will respond to the current and future needs of the industry, higher studies as well as research.

Program Educational Objectives:

1. Graduates of the program will become competent engineers suitable for the mechanical engineering based industry and higher education.
2. Graduates of the program will acquire the necessary foundation in fundamental mechanical engineering subjects for development of mathematical and analytical abilities.
3. Graduates of the program will acquire the knowledge and skills in mechanical engineering to provide technological solutions.
4. Graduates of the program will learn managerial, financial and ethical practices such as, project and financial management skills, multidisciplinary approach and soft skills.
5. Graduates of the program will respond to growing demands of society through lifelong learning.

Program Ontcomes:

At the end of the program, a student will be able to

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. **Design/development of solntions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **1udividual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Projeet management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a meniber and leader in a team, to manage projects and in multidisciplinary environments.
12. **Llfe-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Program Specific Ontcomes:

At the end of the mechanical engineering program, a student will be able to:

1. Identify, automate and apply manufacturing processes for production of mechanical components considering effective use of man, machines, and material resources.
2. Design, formulate, develop and analyze mechanical components and systems using design engineering principles and modern CAD/CAE tools
3. Specify, analyze, evaluate, audit, design and build thermal and fluid systems using modern engineering tools

FINAL YEAR B. TECH (MECHANICAL ENGINEERING), SEMESTER VII (PATTERN 2017) MODULE I (FROM A.Y. 2020-21)

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/ OR/ TW		
MEUA40171	Numerical Methods*	TH	3	-	2	20	30	20	30	25	125	4
MEUA40172	Mechanical Vibration*	TH	3	-	2	20	30	20	30	25	125	4
MEUA40173	Refrigeration and Air Conditioning*	TH	3	-	2	20	30	20	30	25	125	4
MEUA40174	Elective-III	TH	3	-	2	20	30	20	30	25	125	4
MEUA40175	Intellectual Property Rights	CE	2	-	-	-	-	50	-	-	50	2
MEUA40176	Project Work*	CE-PR/OR	-	-	10	100	-	-	-	50	150	5
M4	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
	Total	-	14	-	18	180	120	130	120	150	700	23

*Courses having Practical/Oral

CIE: Continuous Internal Evaluation
ISE: In-Semester Examination
SCE: Skill and Competency Examination
ESE: End Semester Examination

Elective – III:

MEUA40174A	Fluid Machines and Fluid Power Engineering
MEUA40174B	Industrial Engineering
MEUA40174C	Business Analytics

BoS Chairman

Dean Academics

Director

Vishwakarma Institute of Information Technology, Kondhwa Bk. Pune 48. Dept. of Mechanical Engineering

FINAL YEAR B. TECH (COMMON TO ALL PROGRAMS), SEMESTER VII (PATTERN 2017) MODULE II (FROM A.Y. 2020-21)

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	ICE	ISE	SCE	ESE	PR/ OR/ TW		
MEUA40177	Semester Internship*	CE-PR/OR	-	-	24	100	-	-	-	50	150	12
M4	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
	Total	-	-	-	24	100	-	-	-	50	150	12

List of Audit Courses: Professional Ethics; Cyber Security; Value Engineering and Human Rights; Legislative Procedures; Technical Writing/Documentation; Sports/Yoga; Performing Art such as music, dance, and drama etc.; Languages; Online certification course (minimum two weeks); Participation in intercollegiate co-curricular and extracurricular activities.

Vishwakarma Institute of Information Technology, Kondhwa Bk., Pune 48. Dept. of Mechanical Engineering

BoS Chairman | Dean Academics | Director

FINAL YEAR B. TECH (COMMON TO ALL PROGRAMS), SEMESTER VIII (PATTERN 2017) MODULE IV (FROM A.Y. 2020-21)

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	ICE	ISE	SCE	ESE	PR/ OR/ TW		
MEUA40177	Semester Internship*	CE-PR/OR	-	-	24	100	-	-	-	50	150	12
M4	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
	Total	-	-	-	24	100	-	-	-	50	150	12

BoS Chairman

Dean Academics

Director

Vishwakarma Institute of Information Technology, Kondhwa B.K., Pune 48. Dept. of Mechanical Engineering

FINAL YEAR B. TECH (COMMON TO ALL PROGRAMS), SEMESTER VIII (PATTERN 2017) MODULE V (FROM A.Y. 2020-21)

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/ OR/ TW		
MEUA40171	Numerical Methods*	TH	3	-	2	20	30	20	30	25	125	4
MEUA40172	Mechanical Vibration*	TH	3	-	2	20	30	20	30	25	125	4
MEUA40173	Refrigeration and Air Conditioning*	TH	3	-	2	20	30	20	30	25	125	4
MEUA40174	Elective-III	TH	3	-	2	20	30	20	30	25	125	4
MEUA40175	Intellectual Property Rights (IPR)	CE	2	-	-	-	-	50	-	-	50	2
MEUA40176	Project Work*	CE-PR/OR	-	-	10	100	-	-	-	50	150	5
M4	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
	Total	-	14	-	18	180	120	130	120	150	700	23

List of Audit Courses: Professional Ethics; Cyber Security; Value Engineering and Human Rights; Legislative Procedures; Technical Writing/Documentation; Sports/Yoga; Performing Art such as music, dance, and drama etc.; Languages; Online certification course (minimum two weeks); Participation in intercollegiate co-curricular and extracurricular activities.

NOTE:

- **Studeuts who will register for Module-I iu Semester VII have to register either of Module-III or Module IV in Semester VIII.**
- **Studeuts who will register for Module-II in Semester VII have to register for Module-V iu Semester VIII.**

BoS Chairman Dean Academics Director

Vishwakarma Institute of Information Technology, Kondhwa Bk. Pune 48 — Dept. of Mechanical Engineering

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Semester – I

Numerical Mcthods (MEUA40I71)

Teaching Scheme	Examination Scheme						
Credits:4 Lecture (L): 3hrs./week Tutorial (T): -- hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	25	-	125

Prerequisite: Engineering Mathematics I, II and III

Conrse objectives:

- To recognize the difference between analytical and numerical methods and to provide the necessary concepts of a few numerical methods for solving complex Mechanical engineering Problems
- To offer hands-on experience for developing programming skills to provide solutions to mechanical problems using numerical methods.

Coursc Outcomes:

By the end of the course, students will be able to

1. Determine the root to given equations using appropriate numerical method.
2. Implement appropriate numerical method to solve linear systems of equations.
3. Demonstrate the use of regression/interpolation methods to find values based on the graphical and/or tabulated data.
4. Apply numerical methods to obtain approximate integration for given problem.
5. Evaluate an approximate solution of ordinary differential equation.
6. Solve a partial differential equation using finite difference approach.

Unit I – Errors, Approximations and Roots of Eqnation

Errors & Approximations: Significant figures, Accuracy & Precision, Errors Round-Off Error, Truncation Error, Error Propagation

Roots of Equations: Bisection Method, Newton Raphson method, Successive approximation method, Convergence and Divergence

Unit II - SimnItaneons Equations

Gauss Elimination Method, Partial Pivoting, Gauss-Seidal method and Thomas algorithm for Tri-Diagonal Matrix.

Unit III - Curve Fitting and Interpolation

Curve Fitting: Least Square Technique- Straight Line, Power Equation, Exponential Equation and Quadratic Equation.

Interpolation: Lagrange's Interpolation, Newton's Forward Difference interpolation, Inverse Interpolation

Unit IV - Numerical Integration

Trapezoidal rule, Simpson's $1/3^{rd}$ Rule, Simpson's $3/8^{th}$ Rule, Gauss Quadrature Method. Double Integration

Unit V - Ordinary Differential Eqnations

Taylor series method, Euler Method, Modified Euler Method, Runge-Kutta Second Order Method, Runge-Kutta fourth order Method, Simultaneous equations using RungeKutta2nd order method.

Unit VI - Partial Differential Eqnations

Finite-Difference Approximations to Partial Derivatives, Solution of Elliptical and Parabolic Equations, Solution of One-Dimensional Heat Equation, Solution of Wave Equation

Term Work:

Term work shall consist of following assignments.

1. Program on Roots of Equation
   a) Bisection Method or False position Method,
   b) Newton Raphson method or Successive approximation method
2. Program on Simultaneous Equations
   a) Gauss Elimination Method,
   b) Gauss-Seidal method.
3. Program on Numerical Integration
   a) Trapezoidal rule,
   b) Simpson's Rules ($1/3^{rd}$ & $3/8^{th}$)[In one program only]
   c) Double integration
4. Program on Curve Fitting
   a) Straight line,
   b) Power equation Or Exponential equation
   c) Quadratic equation
5. Program on Interpolation
   a) Lagrange's Interpolation,
   b) Newton's Forward interpolation,
6. Program on Ordinary Differential Equations
   a) Euler Method
   b) Runge-Kutta Methods- Second order,
7. Program on Partial Differential Equations

Text Books:

1. B. S. Garewal, Numerical Methods in Engineering and Science: With Programs in C, C++ and MATLAB, New Delhi, Khanna Publishers
2. Jain M K, Iyengar S R K, Jain R K, Numerical Methods for Scientific and Engineering Computation, New Age International (P) Ltd. Publisher
3. Rao V. Dukkipati, Applied Numerical Methods using Matlab, New Age International Publishers

Reference Books:

1. Mathews John H, Fink Kurtis , Numerical Methods Using MATLAB, Dorling Kindersley (India) Pvt. Ltd
2. Stanton Ralph G , Numerical Methods for Science and Engineering, Prentice Hall of India
3. Chapra Steven C; Canale Raymond P , Numerical Methods for Engineers: with Software and Programming Applications, Tata McGraw Hill
4. Balagurusamy, Numerical Methods, Tata McGraw Hill
5. Thangaraj, Computer Oriented Numerical Methods, Prentice Hall of India
6. Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India

Conrse Coordinator: Prof. P.R. Anerao

BoS Member:

BoS Chairman:

Mechanical Vibration (MEUA40172)

Teaching Scheme	Examination Scheme						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): - hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	25	-	125

Prerequisite: Engineering Mathematics, Strength of Materials, Theory of Machines.

Course Objectives:

- To study the fundamentals of free and forced vibrations.
- To develop analytical competency in solving vibration problems.
- To study vibration characteristics of the multi degrees of freedom system.
- To get familiar with various vibrations measurement instruments and control techniques

Course Outcomes:

After successful completion of the course, student will be able to

1. Apply the concept of vibration in mechanical design of machine parts that operate in vibratory conditions.
2. Analyze the mathematical model of a linear vibratory system to determine its response
3. Estimate natural frequency for single DOF undamped& damped free vibratory systems.
4. Determine response to forced vibrations due to harmonic excitation, base excitation and excitation due to unbalance forces.
5. Estimate natural frequencies, mode shapes for 2 DOF undamped free longitudinal and torsional vibratory systems.
6. Describe vibration measuring instruments for industrial/real life applications along with suitable method for vibration control

Unit I: Fundameutals of Vibration

Brief history of mechanical vibration, importance of the study of vibration, elementary parts of vibratory system, degree of freedom, discrete and continuous system, types of vibration, modeling of a system.

Unit II: Undamped Free Vibration of Single Degree Freedom System

Modeling of Vibrating Systems, Evaluation of natural frequency, differential equation, energy and Rayleigh's methods, Equivalent systems- Springs in series and parallel, Natural frequency for longitudinal, transverse, and torsional vibratory systems.

Uuit III: Damped Free Vibration of Siugle Degree Freedom System

Different types of damping, free vibrations with viscous damping, study of vibration response of over damped, critically damped and under damped systems, logarithmic decrement, introduction to equivalent viscous damping.

Unit IV: Forced Vibrations- Single Degree Freedom System

Sources of excitation, resonance phenomenon, forced vibrations of longitudinal and torsional viscous systems, frequency response to harmonic excitation, excitation due to reciprocating and rotating unbalance, base excitation, magnification factor, phase difference.

Unit V: Undamped Vibration of Two Degree Freedom Systems

Free vibration of spring coupled systems – longitudinal and torsional, natural frequency and mode shapes, Eigen value and Eigen vector by Matrix method.

Unit VI: Measurement and Control of Vibration
Vibration measnrements: vibration measuring devices, accelerometers, impact hammer, vibration shaker-construction, principles of operation and uses, vibration analyzer, analysis of vibration spectrum, standards related to measurement of vibration and accepted levels of vibration. **Vibration control:** vibration control methods, passive and active vibration control, control of natural frequency, vibration isolators and undamped dynamic vibration absorbers.
Tntorials:
List of tutorials: 1. To determine natural frequency and stiffness of spring-mass system. 2. To determine the natural frequency of damped vibration of single degree freedom system and to find it's damping coefficient. 3. To determine natural frequency of transverse vibration of beam using vibration analyzer. 4. To determine the frequency response curve under different damping conditions for single degree freedom system of vibration. 5. To verify natural frequency of torsional vibration of two rotor system and position of node. 6. Analysis of machine vibration signature using any analysis software package. 7. Experimental verification of principle of Dynamic Vibration Absorber. 8. Determine the free response of an SDOF damped system with different damping using suitable software. 9. Determine total response of SDOF damped system to harmonic excitation using suitable software. 10. To plot the frequency response curve of single degree mass damper system for different damping factor using suitable software.
Text Books:
1. S. S. Rao, "Mechanical Vibrations", 4th Edition, Pearson Education Inc. New Delhi, ISBN: 9788177588743 2. G. K.Grover, "Mechanical Vibrations", 8th Edition, New Chand and Bros,Roorkee, ISBN:978-81-85240-56-5 3. V. P.Singh, " Mechanical Vibrations", Dhanpat Rai and Sons, New Delhi, ISBN: 1234567150209 4. S. G. Kelly, "Mechanical Vibrations", Schaum's outlines, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 0070340412
Reference Books :
1. W.T. Thomson, Marie Dillon Dahleh, "Theory of vibrations with applications", 5th Edition, Pearson Education Pvt. Ltd., ISBN: 9788131704820 2. W. Weaver, Jr., S. P. Timoshenko, D. H. Young, "Vibration Problems in Engineering", 5th Edition ISBN: 978-0-471-63228-3. 3. Leonard Meirovitch, "Fundamentals of vibrations", Waveland Pr Inc; Reissue edition, ISBN-10: 1577666917

Conrse Coordinator: Prof. N.H.Ambhore/ Dr. P.P.Hujare

BoS Member:

BoS Chairman:

Refrigeration and Air-Conditioning (MEUA40173)

Teaehing Scheme	Examination Scheme						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): -- hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	25	-	125

Prerequisite: Applied Thermodynamics, Heat Transfer

Conrse objectives:

- Learning the fundamental principles and different methods of refrigeration and air conditioning.
- Study of various refrigeration cycles and evaluate performance using Mollier charts and/ or refrigerant property tables.
- Comparative study of different refrigerants with respect to properties, applications and environmental issues.
- Understand the basic air conditioning processes on psychometric charts, calculate cooling load for its applications in comfort and industrial air conditioning.
- Study of the various equipment-operating principles, operating and safety controls employed in refrigeration air conditioning systems.

Course Outcomes:

By the end of the course, students will

1. Illustrate the fundamental principles and applications of refrigeration and air conditioning system.
2. Estimate cooling capacity and coefficient of performance by conducting test on vapor compression refrigeration systems.
3. Describe the properties, applications and environmental issues of different refrigerants.
4. Calculate cooling load for air conditioning systems used for various applications.
5. Demonstrate the refrigeration system
6. Analyze air conditioning systems.

Unit 1 - Fnndamentals & Applications of Refrigeration and Air Conditioning

Reverse Carnot cycle, block diagram of refrigerator & heat pump, modified reverse Carnot cycle (Bell Coleman cycle), Applications of Refrigeration and Air Conditioning, Refrigerants, environmental issues and selection of Compressor

Unit 2 - Vapour Compression Cyele and systems

Working of simple vapour compression system, representation of vapour compression cycle (VCC) on T-s and P-h diagram, COP, EER, SEER, IPLV, NPLV, effect of operating parameters on performance of VCC(Numerical), actual VCC, methods of improving COP using flash chamber, sub-cooling and liquid vapour heat exchanger, comparison of VCC with Reverse carnot cycle.

Unit 3 - Vapour Absorption System

Introduction, Working of simple vapour absorption system (VAS), desirable properties of binary mixture (aqua-ammonia), performance evaluation of simple VAS (simple numerical treatment), actual

VAS, Li-Br absorption system, three fluid system (Electrolux refrigeration), applications of VAS, comparison between VCC and VAC.

Unit 4 - Psyehrometry and Air conditioning Processes

Introduction to air conditioning, psychrometry, psychrometric properties and terms, psychrometric relations, Psychrometric processes and its representation on psychrometric chart, BPF of coil, ADP, adiabatic mixing of two air streams. (Numerical)

Unit 5 - Air conditioning system: Cooling Load Calcnlations

Psychrometric chart with numerical on SHF, RSHF, GSHF, ESHF. factors contributing to cooling load. Cooling Load Calculations (Numerical), Concept of infiltration and ventilation
Thermodynamics of human body, comfort and comfort chart, factors affecting human comfort, , Indoor air quality requirements,

Unit 6 - Air Conditioning systems and Dnets

Air handling unit, Classification of ducts, duct material, pressure in ducts, pressure losses in duct (friction losses, dynamic losses), Working of summer, winter and all year round AC systems and their materials, all air system, all water system, air water system, unitary and central air conditioning.

Term-Work

The Term-Work shall consist of **any eight experiments**

1) Test on Domestic Refrigerator for evaluation of EER
2) Test on vapour compression test rig
3) Test on air conditioning test rig
4) Test on ice plant test rig
5) Test on vapour absorption test rig
6) Visit to Vapour absorption refrigeration plant
7) Estimation of cooling load of simple air conditioning system (case study)
8) Case study on cold storage
9) Visit to any refrigeration or air conditioning plant
10) Thermal analysis of refrigeration cycle using suitable software

Text Books

1. Arora C. P., Refrigeration and Air Conditioning, Tata McGraw-Hill
2. Arora and Domkundwar, Refrigeration & Air Conditioning, Dhanpatrai & Company, New Delhi
3. Khurmi R.S. and Gupta J.K., Refrigeration and Air conditioning, Eurasia Publishing House Pvt. Ltd, New Delhi,1994.
4. Sapali S.N., Refrigeration and Air Conditioning, PHI learning Pvt. Ltd, New Delhi.

Referenee Books :

1. Dossat Ray J, Principles of refrigeration, S.1. version, Willey Eastern Ltd, 2000
2. Stockers W.F and Jones J.W., Refrigeration and Air conditioning, McGraw Hill International editions 1982.
3. Threlkeld J.L, Thermal Environmental Engineering, Prentice Hall Inc., New Delhi
4. Aanatnarayan, Basics of refrigeration and Air Conditioning, Tata McGraw Hill Publications
5. Roger Legg, Air Conditioning System Design, Commissioning and Maintenance
6. ASHRAE & ISHRAE handbook

Course Coordinator: Dr. D.A.Kamble/ Dr. A.D.Kale

BoS Member:

BoS Chairman:

Elective-III : Flnid Machlnes and Fluid Power Englneering (MEUA40174A)

Teaching Scheme	Examination Scheme						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): -- hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Prerequisite: Engineering Mechanics, Engineering Mathematics, Fluid Mechanics.

Conrse Objectives:

- This course elaborates working principles of hydraulic machines and hydraulic and Pneumatic components, overview of various controls and will develop ability to design hydraulic and pneumatic systems. The practical session will develop the ability of hands on experience by demonstration on hydraulic machines, hydraulic and pneumatic cireuits on trainer and design circuits as per the requirement by using manufacturing catalog.

Course Outcomes:

By the end of the course, students will able to

1. Explain construction, operation and design procedure for analysis of Impulse water turbines.
2. Explain construction, operation and design procedure for analysis Reaction water turbines.
3. Analyze the performance of Centrifugal Pumps.
4. Explain fluid power systems and analyze the performance pumps used in hydraulic systems.
5. Explain the types, construction and operation of control valves and actuators.
6. Explain the construction, working principle and design of simple hydraulic and pneumatic circuits.

Unit 1 –Impulse Water Turbines

Introduction to Impulse momentum principle, Classification of water turbines, Pelton wheel, its construction and working, velocity triangles, heads and efficiencies, power, work done analysis, Pelton wheel design, specific speed and Unit quantities, selection, Governing, and performance curves.

Unit 2 –Reaction water tnrbines

Principle of operation, Construction and working of Francis and Kaplan Turbine, comparison,, calculation of various efficiencies, Power, Discharge, Blade angles, Runner dimensions etc. governing of Francis and Kaplan turbine, Draft tube types and analysis, selection, performance curves.

Unit 3 – Ceutrifugal Pnmps

Classification of pumps, components of centrifugal pump, types of heads and efficiencies, types of casing and vanes, velocity triangles and their analysis, multistage pumps in series and parallel, cavitations, NPSH, priming of pumps, specific speed, shape number, performance characteristics of centrifugal pump, system resistance curves and selection of pumps.

Unit 4 –Introduction to Fluid power system and Pumps

Fluid power basics, applications, advantages and limitations, Hydraulic fluid – types, properties and requirements, power units and reservoirs, cylinder mountings., ISO and API standers.

Pumps: Types, classification, principle of working and constructional details of vane pumps, gear pumps, screw pumps, power and efficiency calculations, selection and applications of Pumps etc.

Unit 5–Actuators and Fluid Power Control Valves

Linear and Rotary actuators – types, construction, working principle and characteristics.
Accumulators – types, construction and working principle.
Control valves – construction and working principle of directional, pressure control ,flow control valves, unloading and counter balance valves, sequence valve. Solenoid valves, gate and globe valves.

Unit 6 –Hydraulic and Pnenmatic Cireuits

Hydraulic. Circuits - Simple reciprocating, Speed control (Meter in, Meter out and bleed off), Sequencing, Synchronization, counter balance, unloading circuit, Design of simple hydraulic circuit as per the requirement by manufacturing catalog.
Pneumatic Circuits – Compressors types, filters types, pressure regulators, lubricators, FRL unit, mufflers, dryers, pneumatic actuators , Control valves – Pressure, directional and flow, , shuttle valve, quick exhaust valve and time delay valves. Circuits – Reciprocating, speed control, quick exhaust valve and time delay circuit. Design of simple pneumatic circuit as per the requirement by manufacturing catalog.

Lab :

Lab consist of any ten experiments of the following -

1. Verification of impulse momentum principle.
2. Study and trial on Impulse / Reaction turbines and plotting of main / operating characteristics.
3. Study and trial on centrifugal pump and plotting of operating characteristics.
4. Industrial visit to hydroelectric power / Pumping station plant & report based on it.
5. Test on Gear / Piston pump and plotting of performance characteristics.
6. Study & demonstration of various hydraulic circuits on hydraulic trainer.
7. Study & demonstration of various pneumatic circuits on pneumatic trainer.
8. Industrial visit to automation system and repot based on it.
9. Assignment on ISO symbols for different components of Hydraulic and Pneumatic system.
10. Assignment on different types of actuators used in Pneumatic and Hydraulic system.
11. Design of simple hydraulic / pneumatic systems using manufacturing catalogues.

Text Books:

1. Dr. R. K. Bansal , " Fluid mechanics & Hydraulic machines" , Laxmi Publication Pvt. Ltd. , New Delhi, ISBN : 13: 978-8131808153.
2. Dr. P. M. Modi& Dr. S. M. Seth, "Hydraulics & Fluid Mechanics", Standard Book House, ISBN: 978-81-89401-26-9.
3. **B**. U. Pai, "Turbomachnies", Wiley India, ISBN 13: 9788126539550.
4. Esposito, Fluid Power with application, Prentice Hall, *ISBN* 13: 9780130608994.
5. Majumdar S.R, Oil Hydraulic system- Principle and Maintenance, Tata McGraw Hill, *ISBN* 13: 9780074637487.
6. MajumdarS.R, Pneumatics Systems Principles and Maintenance, Tata McGraw Hill,*ISBN*-13: 978-0074602317.

Reference Books :

1. V.P. Vasandani, Theory of Hydraulic MachinaryKhanna Publishers, Delhi,*ISBN* 10: 0-07-0643419-X.
2. Dr. J. Lal, Hydraulic Machines, Metropolitan Book Co. Pvt. Ltd., Delhi, *ISBN* 10: 0-07-0643419-X.

3. J. J. Pipenger, Industrial Hydraulics, McGraw Hill, *ISBN* 13: 9780070501409.
4. Pinches, Industrial Fluid Power, Prentice Hall, *ISBN* 13: 9780130608994.
5. D. A. Pease, Basic Fluid Power, Prentice Hall, *ISBN*-13: 978-0-323-02622-2.

Course Coordinator: Prof. D.B.Nalawade/ Dr. D.A.Kamble

BoS Member:

BoS Chairman:

Elective-III : Indnstrlal Engineering (MEUA40174B)

Teacbing Scbeme	Examiuation Scheme						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): -- hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Prerequisite(s): Manufacturing Processes, Engineering Mathematics, Computer Fundamentals

Conrse Objectives:

- To introduce the concepts, principles and framework of contents of Industrial Engineering.
- To acquaint the students with various productivity enhancement techniques.
- To acquaint the students with different aspects of Production Planning and Control and Facility Design.
- To introduce the concepts of various cost accounting practices as applied in industries
- To acquaint students with different aspect of simulation modeling for various industrial engineering applications.

Conrse Outcomes:

After successful completion of the course, student will be able to

1. Compute the partial productivity and total productivity indexes considering different influencing factors
2. Analyze each operation with a view to eliminate unnecessary operations, avoidable delays and other forms of waste.
3. Compute the standard time for a qualified worker to carry out a specified job at a defined level of performance.
4. Design a physical arrangement of facilities most economically at optimum plant location.
5. Design the production system considering an estimate of future event through past data.
6. Calculate optimum inventory level by establishing the relationship among the factors affecting profit.

Unit I: Introdnction to Indnstrial Engineering and Productivity

Definition, Industrial engineering approach, Objectives of Industrial Engineering Role of Industrial Engineer, Techniques of industrial Engineering, Industrial engineering in service sector, Measurement of productivity: Factors affecting the productivity, Productivity Models and Index, Productivity improvement techniques.

Unit II: Method Study

Work Study: Definition, Objectives, Procedure, Concept of work content, Method Study: Definition, Objectives, Scope and Steps involved in method study, Recording techniques, Micro-motion study, Cycle graph and chronocycle graph, Critical examination, Principles of motion economy, Concepts of value engineering and value analysis.

Unit III: Work Measurements

Work Measurements: Definition, Objectives and techniques of work measurement, Steps in making time study, Types of elements, Time study equipment's, Performance rating, Allowances, Computation of standard time, Comparison of various techniques, Introduction to PMTS, MTM and MOST.

Unit IV: Plant Location and Plant Layont

Need for selecting a suitable plant location, Factors influencing plant location, Comparison between urban and rural locations, Quantitative method for evaluation of plant location, Plant Layout: Objectives, Principles, Types, Factors affecting plant layout, Types of manufacturing systems, Tools and techniques of plant layout, Computer packages for layout analysis.

Unit V: Prodnction Planning and Control – I (PPC – I)

Production Planning and Control (PPC): Need, Objectives, Functions, Production procedure, Measures of capacity, Capacity planning, Factors influencing effective capacity, Aggregate planning: Methods, advantages and limitations, Demand forecasting: Need and classification (Least square method, moving average, weighted moving average, exponential smoothing method and Casual forecasting method.

Unit VI: Production Planning and Controi – II (PPC – II)

Inventory types, Inventory control: Objectives and benefits, Inventory cost relationships, Inventory models: Basic inventory models, (with and without shortage and discount), Selective control of inventory: ABC and VED analysis, Production cost concepts and break-even analysis, Cost-volume-profit analysis..

Practical:

List of Practical (Any Six)

1. Case study-based assignment on method study.
2. Case study-based Assignment on work Measurement technique(s).
3. Assignment on analysis of manufacturing/service operation for capacity planning.
4. Assignment on simulation of manufacturing system/service system operations for demand forecasting.
5. Assignment on simulation determination of EOQ and plot the graphs.
6. Assignment on industrial safety audit of selected work environment.
7. Case Studies (anyone): Industrial Engineering in a) Healthcare services, b) Banking, c) Agricultural Production d) Film production and distribution, e) Hotels and restaurants, f) Tourism and g) Sports

Textbooks:

1. M Mahajan, Industrial Engineering and Production Management, Dhanpat Rai and Co.
2. O. P. Khanna, Industrial engineering and management, Dhanpat Rai publication
3. Martend Telsang, Industrial Engineering, S. Chand Publication.
4. Banga and Sharma, Industrial Organization& Engineering Economics, Khanna publication

Reference Books:

1. Introduction to Work Study by ILO, ISBN 978-81-204-1718-2, Oxford & IBH Publishing Company, New Delhi, Second Indian Adaptation, 2008.
2. H. B. Maynard, K Jell, Maynard 's Industrial Engineering Handbook, McGraw Hill

Education.
3. Askin, Design and Analysis of Lean Production System, Wiley, India
4. Zandin K.B., Most Work Measurement Systems, ISBN 0824709535, CRCPress,2002
5. Martin Murry, SAP ERP: Functionality and Technical Configuration, SAP Press; 3rdNew edition (2010).
6. Barnes, Motion and time Study design and Measurement of Work, Wiley India
7. Raid Al-Aomar, Adwerd J Williams, Onur M. Uigen 'Process Simulation using WITNESS', Wiley

Course Coordinator: Dr.S.S.Chinchanikar

BoS Member:

BoS Chairman:

Elective-III: Business Aualyties (MEUA40174B)

Teaching Scheme	Examiuatiou Scheme						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): -- hr. Practieal (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Course Objectives:

- To study the fundamentals of Business Analytics
- To study of powerful visualizations, reports and dashboards
- To understand the process of data export and import in Power BI tool
- To learn the process of Customized calculation writings with the help of tool
- To understand the deployment of reports and dashboards for user consumption.

Course Outeomes: At the end of the eourse the students will be able to:

1. Explain the importance of analytics and need of data preparation for analytics.
2. Evaluate the different components of analytics landscape and project eycle aligned with these components.
3. Explain data transformation, data modelling and visualize the data on the data models
4. State the ways of adding custom calculations and applications of different statistical concepts.
5. Explain the deployment, administration cycle of analytics implementations using Power BI.
6. Illustrate various topics and concepts in the areas of analytics through industrial applications case studies.

Unit I - Need Of Analyties And Data Preparation

Introduetion to Analyties: What is Analytics? Need of Analytics Why Microsoft Power BI? Types of Business Analytics

Data Sources: Data Collection, Transactions Entry, Organizational Systems, Data Sources and Data Source Categories, Issues in Data and Need of Data Preparation

Need of Data Preparatious: What is Data Preparation? Joining data, Appending Data, New Calculations, Removing Inconsistencies, Transposing

Setting up Power BI: Installation and configuration of Power BI Desktop, Setup of required connector

Unit II– Data Laudscape Aud Project Cycle

Uuderstanding Data and Databases: What is a database? What is a DBMS? What is SQL? What are tables? Organization of tables in databases, Types of Data, Database Keys, Relationships between tables, Joins and Unions, Cross-database Joins, Type of Data: Structured, Unstructured and Semi-structured data

Data Arehiteeture: BI Architecture, Data Security and Governance, Administration

Analytics Projeet Lifeeyele: Requirements Understanding, Data Understanding, Wireframes, Data Preparation, Data Visualization, Deployment, Documenting, Project Team and Roles, Challenges in Projects.

UNIT III: Data Modeliing And Visnaiization

Data Integratiou and Data Warehouses: What is Data Integration? Need of Data Integration, ETL, What is Data Warehouse? Need of Data Warehouse, Facts and Dimensions Star Schema and Snowflake Schema, Data Marts **Data Trausformatiou [Basies]:**Merging and Appending Data, Filtering, Cleaning Data, Fixing Errors, Transforming Data, Aggregating Data, **Data Modelliug:** Setting Relationships, Creating Data Models **Data Visualizatiou:** What are KPIs? Dashboards, Reports and Scorecards, Types of Dashboards, Slicers and Filters, Setting interactivity, Creating Hierarchies, Groups, Drilldowns and Drill-through, Formatting your visualizations, Best practices of visualizations, Aggregations: SUM, MAX, AVG, MIN
Unit IV: Custom Caleulations And Aualytics
Data Transformatious [Advanced]: Tabular Model at database level, Cross-database joins **Caleulations:** Calculated Fields, Calculated Measures, Time-intelligent Functions, Moving Averages and Running Total, What-if Analysis, Conditional formatting **Statistieal Aualytics:** Mean, Mode, Median, Variance and Standard Deviation, Simple Regression, Multiple-Regression.
UNIT V: Power Bi Deploymcut, Administration Aud Mobility
Power BI Deployment: Overview of Power BI Service, Publishing to Power BI Service, Understanding the Power BI Service Workspaces, Apps, Creating Dashboards in Power BI Service, Subscriptions, Comments and Data Driven Alerts, Authoring reports within Power BI Service, Sharing dashboards across your organization, Configuring Gateways, Scheduling automated refresh of your reports using Data Gateway Power BI Advanced Features: Using NLP to creating dashboards, Influencers, Delivering Insights, Explain Analysis Mobile Analytics: Creating Dashboards for Mobiles, Using dashboards and reports using Mobile App
UNIT VI: Industry Aualyties Landscape
Working with Tableau: Introduction to Tableau, Installation and Setup of Tableau Desktop, Visualizing with Tableau Advanced Concepts: Web Analytics, Sentiment Analysis, Big Data, Data Lakes, IoT Applications of Business Analytics: Manufacturing Use Cases, EPC Use Cases, Retail Use Cases, Future Trends of Analytics
Term Work: The following exercises should be prepared and submitted: 1. Creating multiple sample tables and joining them in Power BI 2. Connecting to data souree and transforming data in Power BI 3. Connecting to data source and creating data models by establishing relationships 4. Connecting to data source and visualizing and analyzing data 5. Connecting to data source and creating custom calculations 6. Deploying the dashboards and reports to Power BI Service 7. Administering and using advanced features of Power BI Service 8. Creating Mobile layouts in Power BI Desktop
Rcfercnce books: 1. "Business Intelligence Guidebook: From Data Integration To Analytics" by Rick Sherman, Elsevier Inc.

2. "Successful Business Intelligence, Second Edition: Unlock the Value Of Bl & Big Data" by Cindi Howson, McGraw Hill Edition
3. "Data Analytics For Beginners: Your Ultimate Guide To Learn And Master Data Analysis. Get Your Business Intelligence Right – Accelerate Growth And Close More Sales" by Victor Finch
4. Data Strategy: How To Profit From A World Of Big Data, Analytics And The Internet Of Things" by Bernard Marr, Kogan page Publications, Auva Press
5. "Performance Dashboards – Measuring, Monitoring, And Managing Your Business" by Wayne Eckerson, John Wiley & Sons, Inc
6. "Business Intelligence Roadmap: The Complete Project Lifecycle For Decision Support
7. Applications" by Larissa T. Moss & Shaku Atre, Addison-Wesley information Technology Series
8. "Artificial Intelligence: Building Intelligent Systems" by Dr. Parag Kulkarni, Dr. Prachi Joshi,
9. PHI publication (for understanding of concepts)

Course Coordinator:

BoS Member:

BoS Chairman:

Intellectnal Property Rights (MEUA40175)

Teaching Scheme	Examination Seheme						
Credits: 2 Lecture (L): 2 hrs./week Tutorial (T): hr. Practical (P): - hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	-	-	50	-	-	-	50

Course objcctives:

- The course is designed to introduce fundamental aspects of Intellectual property Rights.
- The course introduces all aspects of the IPR Acts.
- It also includes case studies to demonstrate the application

Course outeomes:

Upon completion of course, students will be able to

1. Define intellectual property right (IPR).
2. Describe iinpact of intellectual property right (IPR) and patentability.
3. Demonstrate the procedure for filing a patent and copyright.
4. Describe the importance of trademark in industry.

Uuit 1: Overview of Intellectual Property

Introduction and the need for intellectual property right (IPR) IPR in India – Genesis and Development IPR in abroad Some important examples of IPR

Unit II : Pateuts

Macro economic impact of the patent system, Patentability, Types of IP tools, Copyright, trademarks, Patent databases, Patent document and its search, Rights of a patent,

Uuit III : Pateut Search

Searching a patent, Patent database, Patent free database. Patent structure, Patent grants Procedure in India, Different layers of the international patent system (National, Regional and international options). Copyright- Definition of copyright, Content of copyright, What are related rights, Rights covered by copy right.

Unit IV : Trademark

Definition of trademark, Rights of trademark, Kind of signs can be used as trademarks, Types of trademark function, Protection of trademark, Trademark registration.

Text Books :

1. Resisting Intellectual Property by Halbert ,Taylor & Francis Ltd ,2007
2. Industrial Design by Mayall, McGraw Hill
3. Intellectual Property Rights Under WTO by T. Ramappa, S. Chand
4. Encyclopedia of Ethical, Legal and policy issue in Biotechnology by T. M. Murray and M. J. Mehlman, John Wiley and Sons 2000.

Reference Books :

1. Nanotechnology Intellectual Property Rights: Research, Design, and Commercialization by Dr. S. K. Jabade, CRC Press
2. Product Design by Niebel, McGraw Hill
3. Introduction to Design by Asimov, Prentice Hall
4. Intellectual Property in New Technological Age by Robert P. Merges, Peter S. Menell, Mark A. Lemley

Course Coordinator: Dr. D.A.Kamble/Dr.S.S.Kore

BoS Member:

BoS Chairman:

Project Work (MEUA40176)

Teaching Scheme	Examination Scheme						
Credits: 5 Lecture (L): - hrs./week Tutorial (T): hr. Practical (P): 10 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	100	-	-	-	50	-	150

Prerequisite: All Mechanical Engineering Subjects till semester VI

Course objectives:
To train the students to apply their engineering knowledge to real life problem solving. And to plan. implement and execute project work to satisfy the stated objectives of the project

Course Outcomes:
By the end of the course, students will be able to

1. Identify and formulate the problem related to mechanical engineering based on literature survey
2. Apply concepts and modern engineering tools to design the solution for identified problem
3. Develop a system, component or process to meet desired needs considering the standards and codes
4. Prepare a plan of activities according to the time frame and budget
5. Prepare and present technical report.
6. Work in a group as a part of multidisciplinary team with professional responsibility.

The students in a group of not more than FOUR will work under the guidance of the faculty member on the project work undertaken by them. The completion of work, the submission of the report and assessment should be done at the end of BE semester I/II.

The project work could be of the following nature:

- Design/development and Fabrication of models. Machines and prototypes based on new ideas, robotic and automation systems, Experimental set ups. Test rigs equipments.
- Thermal Systems
- Energy audit conservation studies
- Extensive computational analysis of problems relevant to mechanical engineering.
- CAD/CAM/CAE
- Modeling/simulation of product(s). mechanism(s) or system(s) and its validation or comparison with available bench mark results

A report containing maximum 50 pages shall be submitted based on the project. Report should contain following points:

- Background, need and scope of the project,
- Project specifications,
- Activities involved in the project and activity plan.
- Study of literature and basic theory.

Conrse Coordinator: Prof. P.R. Anerao

BoS Member:

BoS Chairman:

Semester- II

Elective-IV: Reliability Engineering (MEUA42171A)

Teaching Scheme	Examination Scheme						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): -- hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	25	-	125

Perquisite: Engineering Mathematics, Manufacturing Processes and Design Engineering

Course Objectives:

Understanding of basic principles of Reliability for ensuring sustainable product design.
Application to system requirements, design, manufacturing and testing, with real-world examples.
Understand in detail Asset Management, Maintenance, Quality and Productiveness

Course Outcomes:

Upon completion of the course, students will be able to

1. Calculate MTTF, MTBF, failure rate and hazard rate for life characteristic phases of system
2. Analyze series, parallel, mixed configuration systems using probability concepts.
3. Estimate reliability of a system using different reliability apportionment techniques.
4. Calculate inherent, achieved and operational availability of system.
5. Explain FEMA, FMECA and DOE
6. Explain different methods to test reliability.

Unit I: Fuudameutals Coucepts of Reliability

Reliability terminologies, Interrelationship of safety, quality and reliability, life characteristic phases, Introduction to maintainability, availability. Concepts of Failure, failure density, failure Rate, hazard rate, pdf, cdf. Modes of failure, Mean Time To Failure (MTTF), Mean Time Between Failure (MTBF), Numericals based on calculation of failure rate, hazard rate. Warranty Management and Life cycle cost.

Unit II: Probability Concepts and System Reliability

Basic probability concepts, Discret and continuous probability distributions, Analysis of series, parallel, mixed configuration systems, Concept of k-out of n structure, Conditional probability method, delta-star method for conditional probability analysis, Tie-set and Cut Set method (Concepts and Numericals).

Unit III: System Reliability Aualysis

Reliability Improvement- Redundancy, element redundancy, unit redundancy, standby redundancy (Numericals), Introduction to Reliability allocation or apportionment, reliability apportionment techniques: Equal apportionment, AGREE, ARINC, Minimum effort method (Numericals).

Unit IV: Reliability Management

Objectives and types of maintenance, Maintainability, system down time, availability - inherent, achieved and operational availability (Numerical treatment). Introduction to Reliability Centered Maintenance. Design for maintainability and its considerations, Reliability and costs, Costs of Unreliability, Technology aspects in Reliability Management, BIT (Built in testing).

Unit V: Reliability in Design and Development

Reliability techniques- Failure mode, effects analysis (FMEA), Failure mode, effects and criticality analysis (FMECA)- Case Studies, Basic symbols, Fault Tree construction and analysis, Introduction to Design of Experiments (DOE).
Unit VI: Reliability Testing
Introduction to reliability testing. Stress strength interaction, Testing for Reliability and Durability- Accelerated Life Testing and Highly Accelerated Life Testing (HALT); highly accelerated stress Screening (HASS). Reliability in manufacturing- Production FRACAS.
Assignments: 1. Calculation of MTTF, MTBF, failure rate and hazard rate for life characteristic phases of system 2. Assignment on analysis of series, parallel, mixed configuration systems using probability concepts. 3. Assignment on application of different reliabity apportionment techniques to improve relaiability of system. 4. Assignment on calculation of inherent, achieved and operational availability of system. 5. Perform FEMA, FMECA of any mechanical system 6. Assignment on application of different methods to test reliability of system 7. Assessment of reliability of cutting tool during turning
Text Books : 1. Kapur — Reliability in engineering Design, Wiley india 2. L.S.Srinath, Reliability Engineering, EWP , 4th Edition 2011
Refereuce Books : 1. Alessandro Birolini, Reliability Engineering Theory and Practice, Springer 2. S S. Rao, Reliability Based Design, McGraw Hill Inc. 1992

Conrse Coordinator: Dr. S.S.Chinchanikar

BoS Member:

BoS Chairmau:

Elective-IV: Composite Material (MEUA42171B)

Teaehing Seheme	Examination Scheme						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): -- hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	25	-	125

Prereqnisite: Strength of Material, Design of Machine Elements, Material Science

Course Objectives :

- To understand importance of composite materials in various applications such as aerospace, automotive
- To understand various fabrication methods of composite material .
- To know various composite testing methods and standards of testing
- To develop an understanding of the micro and macro mechanical analysis of composite materials

Conrse Outcomes :

By the end of the course, students will able to

1. Identify different types of composite materials and its constituents and list its applications in various fields
2. Explain the various manufacturing methods of composite materials
3. Apply various ASTM testing standards for characterizing composite materials
4. Apply strength of material approach to analyze a lamina at micromechanical level
5. Analyze composite lamina at macromechanical level
6. Apply Classical Lamination Theory for the analysis of composite laminates

Unit I : Introdnetion to Composite Material

Introduction to Composite Materials, classification of composite materials, Matrices and Reinforcement, Types of Fiber Reinforcement, Types of matrix materials - Thermoset and Thermoplastic, Advantages and Disadvantages, Applications of composite materials, Mechanics Terminology

Unit II : Mannfacturing of Composite Material

Composite Manufacturing Processes, Hand Lay-up process, Compression molding process, Vacuum Impregnation Methods, Resin Transfer molding, Filament winding , Pultrusion , Prepregs, Stacking of reinforcements

Unit III : Composite Material Characterization

Composite testing, Need for testing ,Major types of testing, Physical testing, Mechanical testing as per ASTM standards- Tensile, compression, shear, flexural, impact, fatigue and creep test, Chemical testing , Thermal testing Volume and Mass Fractions, Density, and Void Content

Unit IV : Micromechanical Analysis of a Lamina

Evaluation of the Elastic Moduli- Strength of material approach: Representative Volume Element (RVE), Rule of Mixtures, Inverse Rule of Mixtures. Ultimate Strengths of a Unidirectional Lamina, Coefficient of thermal expansion , Coefficient of moisture expansion

Unit V : Macromechanical Analysis of Lamina
Hooke's Law for Different Types of Materials- Anisotropic Material, Orthotropic/Specially Orthotropic, Hooke's Law for a Two-Dimensional Unidirectional Lamina, Plane Stress Assumption, Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of a Lamina, Two-Dimensional Angle Lamina, Strength Failure Theories of an Angle Lamina- Tsai–Wu Failure Theory
Unit VI : Macromechanicai Analysis of Laminates
Laminate Code, Classical Lamination Theory - Stress–Strain and Strain-Displacement Equations, Strain and Stress in a Laminate, Force and Moment resultants related to Midplane Strains and Curvatures, extensional, coupling, and bending stiffness matrices, analyzing a laminated composite. Special Cases of Laminates- Symmetric Laminates, Cross-Ply Laminates, Angle Ply Laminates, Antisymmetric Laminates, Balanced Laminate, Quasi-Isotropic Laminates
Text Books :
1. Autar K. Kaw, Mechanics of Composite Materials, , CRC, Taylor and Francis 2006, ISBN:10:0-8493-1343-0. 2. Robert M. Jones, Mechanics of Composite Materials, Taylor and Francis 2010, ISBN:10:1-56032-712-X. 3. Madhujit Mukhopodhyay , Mechanics of Composite Materials and Structures , University Press (India) PVT Ltd, 2009, ISBN: 9788173714771 4. Mallick PK, Fiber-reinforced composites: materials, manufacturing, and design. CRC press, Taylor and Francis Group 2007; ISBN: 13: 978-0-8493-4205-9.
Reference Books :
1. Isaac M. Daniels, Ori Ishai, "Engineering Mechaincs of Composite Materials", Oxford University Press, 1994. 2. Bhagwan D. Agarwal, Lawrence J. Broutman, "Analysis and Performance of fiber composites", John Wiley and Sons, Inc. 1990. 3. Mathews, F. L. and Rawlings, R. D., "Composite Materials: Engineering and Science", CRC Press, Boca Raton, 03. 4. Mazumdar S. K., "Composaite Manufacturing – Materials, Product and Processing Engineering", CRC Press, Boca Raton, 02.
Assignments: 1. Demonstration on manufacturing of synthetic fiber reinforced composite laminate using compression molding machine. 2. Demonstration on manufacturing of synthetic fiber reinforced composite laminate using vacuum bagging technique 3. Tensile testing of composite coupon specimen 4. Micromechanical Analysis of lamina using MATLAB; 5. Macromechanical Analysis of lamina using MATLAB; 6. Macromechanical Analysis of laminate using MATLAB

Course Coordinator: Dr. A.R.Mache

BoS Member:

BoS Chairman:

Elective-IV: Energy Engineering (MEUA42171C)

Teaching Scheme	Examination Scheme						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): -- hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	25	-	125

Prerequisite: Applied Thermodynamics, Turbo-machines

Course objectives:

- To study the power generation scenario, the components of thermal power plant, improved Rankin cycle, Cogeneration cycle
- To understand details of steam condensing plant, analysis of condenser, the an environmental impacts of thermal power plant, method to reduce various pollution from thermal power plant
- To study layout, component details of hydroelectric power plant, hydrology and elements , types of nuclear power plant
- To understand components; layout of diesel power plant , components; different cycles ; methods to improve thermal efficiency of gas power plant
- To study the working principle , construction of power generation from non-conventional sources of energy
- To learn the different instrumentation in power plant and basics of economics of power generation.

Course Ontcomes:

By the end of the course, students will

1. Describe the power generation scenario, the layout components of thermal power plant and analyze the improved Rankin cycle, Cogeneration cycle
2. Analyze the steam condensers, recognize the environmental impacts of thermal power plant and method to control the same
3. Describe the layout, component details of hydroelectric power plant and nuclear power plant
4. Explain the details of diesel power plant, gas power plant and analyze gas turbine power cycle
5. Describe the fundaments of non-conventional power plants.
6. Describe the different power plant electrical instruments.

Unit 1 - Thermal Power Plant

Introduction: General layout of modern power plant with different circuits, working of thermal power-plant, coal classification and its CV, high pressure boilers (Latest three), Rankine cycle with reheat and regeneration (Separate Numerical with Mollier Diagram) , Cogeneration power plant (with numerical)

Unit 2 Steam Snrface Condeuser and Cooling Tower

Steam Condenser: Necessity of steam condenser, Classification, Cooling water requirements, Condenser efficiency, Vacuum efficiency,(Numerical) Cooling towers (Performance Parameters), air Leakage, Effects of Air Leakage on condenser performance, (Numerical Treatment)

Unit 3 – Hydroelectric Power Plant

Introduction, Site Selection, Advantages and Disadvantages of HEPP, Hydrograph, Flow duration curve, (Numerical) Mass Curve, Classification of HEPP with layout.

Nnclear Power Plants: Elements of NPP, Nuclear reactor & its types, fuels moderators, coolants, control rod, classification of NPP, N-waste disposal (No Numerical)

Unit 4 - Gas Tnrbine Power Plant

Layoùt of Gas Turbine Power Plant with Important Systems, Brayton Cycle analysis, Thermal Efficiency, Work ratio, maximum & optimum pressure ratio, Isentropic Efficiency of Compressor and Turbines, Inter-cooling, reheating, & regeneration cycle, (Separate Numerical) Combined power cycle plant.

Unit 5 - Non-Conventional Power Plants

Wind Power Piant: Introduction, wind availability measurement, types of wind machines, site selection, and wind power generation.
Solar Power Plant : Low & High Temperature Solar Power Plant, Photovoltaic Power System (Case Study), Heliostat, Challenges in commercialization of Non-Conventional Power Plants.

Unit 6 Power Piant Instrnmentation

Generator, Transformers, Exciters, Switch Gear, Circuit breakers, Protective Devices and Control Systems, Boiler Instrumentation and Control

Term-Work

The Term-Work shall consist of any eight experiments

1) Study of High Pressure boilers.
2) Visit to thermal Power plant /Co-generation Power plant to understand layout and specifications of main components.
3) Visit to any Non-Conventional Power Plants.
4) Trial on steam power plant.
5) Simulated performance of Steam Power plant with suitable software.
6) Simulated performance of Gas Turbine Power plant.
7) Trial on Diesel Power Plant to understand performance parameters by Graphs.
8) Power plant Instrumentation.
9) Case study on Solar/Wind with numerical or suitable software.

Text Books

1) P.K.Nag, —Power Plant Engineering‖, McGraw Hill Publications New Delhi.
2) Mahesh M Rathore, - Thermal Engineering, Tata McGraw Hill, New Delhi
3) S.P.Sukhatme, —Solar Energy‖ Tata McGraw-Hill Publications, New Delhi (Latest Edition)

Reference Books :

1. Domkundwar & Arora, —Power Plant Engineering‖, Dhanpat Rai & Sons, New Delhi.
2. R.K.Rajput, —Power Plant Engineering‖, Laxmi Publications New Delhi.
3. R.Yadav , —Steam and Gas Turbines‖ ,Central Publishing House, Allahabad.
4. Cengel Boles, Thermodynamics An Engineering approach, The Tata McGraw Hill, New Delhi
5. G.D.Rai, — Non-Conventional Energy Sources‖ Khanna Publishers,Delhi

Conrse Coordinator: Dr. A.D. Kale

BoS Member:

BoS Chairman:

Open Elective-I: Introdnction to Gaming (IOEUA42172A)

Teachiug Scbeme	Examination Scheme						
Credits: 3 Lecture (L): 2 hrs./week Tutorial (T): -- hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Prerequisite: Readers/students are expected to know the following concepts:
1. Basics of Probability

Conrse Objectives:
- To learn about the video game art principles, Video Game production, Design Process and the Industry
- To understand and distinguish Video game elements, genres, types ad hardware
- To Study various video game production practices, terminology, Industry roles and responsibilities
- To know the application and use of a game engine across various verticals and develop and learn how to work with the game engine as a tool for production
- To examine and game engine interface, coding, game objects, asset Store, services, etc

Conrse Ontcomes:
1. Use terminology related to Games and Interactive Media Industry.
2. identify industry demands and structure project as per required specifications
3. Define Specifications for the execution of the project
4. Demonstrate game engine tools usage across art, animation, asset management, Interface, Audio, Lighting, Materials, Physics and Programming systems.
5. Select gaming services related to project structure
6. Develop basic interactive games

Unit- I : Introduction to Games Industry
Video game production techniques, hardware, production roles and responsibilities, Video game design elements, game genres, game types, examples of gaming platforms, gaming services, video game controls, video game industry terms, model asset optimization, asset store, video game art principles, video game industry practices, video game industry terminology

Uuit-1I : Game Engine Fundamentals
Gaming engine user interface, hierarchy, editor, game Window, navigation, inspector, scene, project, game object, prefab, models, tags, sounds, assets, project management, materials, textures, effects, lights, modelling practices and optimization practices, Import system, managing materials, managing textures

Unit III: World Bnilding aud Animation

Environment, Static Meshes, Rigid Body, Colliders, Preparing for lighting, Light tools, light types, User Interface, Art principles, Sprite editor, Lighting process, Baking process, Animated objects,

Importing animation, Setting up animation states, Animation controllers, Transition, Animation refinement.

Unit IV: Scripting a Game Development

Script types, Variables, Methods, C# fundamentals, Game mechanics, Ray casting, Program Debugging, Various Error states, Navigation, Nav Mesh, Building NPC, Simple AI, Enemy System, Particle system, Adding Game audio, Audio types, Audio formats, Audio clips and properties, Camera System, Building camera system, Player Behaviors, User Interface system, User Interface Implementation, Properties of UI, Build tools, Cloud Services, Console, Build Settings, Platforms, Publishing tools, Mobile Publishing

Text Books :

1. Tom Meigs, Ultimate Game Design: Building Game Worlds 1st Edition, McGraw-Hill Education, 2003
2. Sam R. Kennedy, How to Become a Video Game Artist: The Insider's Guide to Landing a Job in the Gaming World, Watson-Guptill, 2013

Refereuce Books :

1. Penny de Byl, Holistic Game Development with Unity: An All-in-One Guide to Implementing Game Mechanics, Art, Design and Programming, 2nd Edition, A K Peters/CRC Press, 2017
2. Mike Geig, Unity 2018 Game Development in 24 Hours, Sams Teach Yourself, 3rd Edition, Sams Publishing, 2018

List of Assignments

Develop a game "Roller Madness" in Unity environment as following assignments

1. Implement the Setting Up the Scene, Camera Setup
2. Implement the Physics system
3. Configure the Player Control and Appearance
4. Health and Damage, Pickups,
5. UI Basics and Game Manager,
6. Create the Enemies
7. Implement the Particle System
8. Implement Animations to the game avatar
9. Spawners to create multiple objects of same type

Note : Do any 6 assignments based on syllabus

Conrse Coordinator:

BoS Member:

BoS Chairman:

Open Elective-I: Inferential Statistics for Data Science (IOEUA42172B)

Teaching Scheme	Examination Scheme						
Credits: 3 Lecture (L): 2 hrs./week Tutorial (T): -- hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Prerequisite: Readers/students are expected to know the following concepts:

2. Basics of Probability

Conrse Objectives:

- To equip students with the basic understanding of the fundamental concept of data and the nature of data sets
- To understand the fundamentals of probability distributions and their application for data analysis
- To derive the conclusions from the data sets with Bayesian and Inferential statistics

Conrse Outeomes:

1. Explain the nature and central tendency of given data sets using appropriate probability distribution for the given data set.
2. Estimate probability of unknown parameters of statistical model using the fundamentals of Bayesian statistics.
3. Analyze and conclude the hypothesis using inferential statistical tests
4. Evaluate the prominent characteristics of data sets with exploratory data analysis methods

Unit- I : Understanding Data and probability distribntions

Understanding Data, Frequency Tables, Distributional Shapes, Central Tendency Describing Spread: Range, Interquartile Ranges and Standard Deviation , Measuring Data ,Measurements of Central Tendency, Measurements of Dispersion, Bi-variate Data and Covariance ,Pearson Correlation Coefficient, Uniform Distribution, Binomial Distribution, Poisson Distribution, Normal Distribution, Normal Distribution - Formulas and Z Scores

Unit-II : Bayesian Statistics

Likelihood function and maximum likelihood, The minimaxity, Computing the MLE, Computing the MLE: examples ,Continuous version of Bayes' theorem, Priors and prior predictive distributions

Prior predictive: binomial example, Posterior predictive distribution, Bernoulli/binomial likelihood with uniform prior, Conjugate priors

Unit III: Inferentiai analysis

Central limit theorem and Hypothesis Testing , t-tests, Sensitivity Analysis ,chi square test, Correlation-values and confidence intervals, Use Analysis of Variance (ANOVA) or Analysis of Covariance (ANCOVA),Regression analysis

Unit IV: Exploratory Data Analysis

Univar ate data: measures of center and spread, transformations, visualization. – Bivariate data: Simple regression, curve fitting, – Trivariate/Hypervariate data: Multiple regression, model selection, principal components. – Binary responses: Logistic regression, residuals. – Categorical data: Contingency tables, correspondence analysis. – Distance data: Multi-dimensional scaling, non-linear dimensionality reduction. – Graph data: Descriptive statistics, spectral methods, visualization.

Text Books :

1. Sahu, Pradip Kumar, Pal, Santi Ranjan, Das, Ajit Kumar, "Estimation and Inferential Statistics", Springer
2. S.C. Gupta and V. K. Kapoor : Fundamentals of Mathematical Statistics, Sultan Chand and Sons, 88, Daryaganj, New Delhi, 2.
3. Manoj Kumar Srivastava, Abdul Hamid Khan, Namrata Srivastava, "Statistical Inference, Theory of estimation", PHI

Reference Books :

1. George Casella, Roger Berger," Statistical Inference ",CENGAGE Learning, Second Edition
2. Malcom O, Asadoorian, Demetri Kantarelis, "Essentials of Inferential Statistics", University Press of America

Practicals: Practicals can be done nsing Python/R

Study of Hypothesis testing(One sample t test, z test)

1. Analysis of variance (ANOVA)
2. To study Linear regression to predict the outcome of a variable
3. 4.Study of outlier in Predictive analysis
4. Finding the most important predictor variable in a dataset for feature Selection
5. 6.Model selection and analysis for a real world dataset
6. 7.Study of Logistic Regression
7. 8.To build an application: Time series forecasting

Conrse Coordinator:

BoS Member:

BoS Chairman:

Open Elective-I: Solar and Wind Energy (IOEUA42172C)

Teaching Seheme	Examination Scheme						
Credits: 3 Lecture (L): 2 hrs./week Tutorial (T): hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	I25

Prereqnisite: : Basic Mechanical Engineering, Basic Electrical and Electronics Engineering and Heat Transfer

Conrse Objeetives:

- To understand fundamentals of solar and wind energies.
- To understand constructions, working principle and design procedure of solar and wind power plants.
- To apply basic engineering principle to design a simple solar and wind power system.

Conrse Outcomes:

After successful completion of the course, student will be able to

1. Explain solar radiation and geometry principles.
2. Apply aspeets of solar thermal system and its practical applications.
3. Design solar food drier/solar cooker/solar pv system for domestic purpose.
4. Design miniature wind mill for domestic purpose referring existing system.

Unit I: Soiar Energy Prineiples

Present solar energy scenario, world energy futures, governing bodies (self-study), solar radiations and its measurements, solar constant, solar radiation geometry, solar radiation data, estimation of average solar radiation, solar radiation on tilted surface.

Unit II: Soiar Thermal Systems and Applications

Types of Solar thermal collector, flat plate collector analysis, Evacuated tube collectors (ETC) analysis, its design and application, solar air heaters and its types, solar distillation.
Solar Concentrating collectors: types- line and point concentrator, theory of Concentrating collectors, parabolic trough collector, parabolic dish collector, solar tower, concentrated Fresnel linear receiver (CFLR).

Unit III: Soiar Photovoitaie and Applications

Forming the PN junction solar cells & its applications, Structure of a solar cell, types of modules, PV array, solar cell equation, Fill factor and maximum power, Grid aspects of solar power, equipment used in solar photovoltaic plants, Power Conditioning Equipment-inverters, Regulators, Other Devices; System Analysis-Design Procedure, Design Constraints, Other Considerations.

Unit IV: Wind Energy

Prineiple of wind energy conversion; Basic components of wind energy conversion systems; various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations, wind energy potential and installation in India.

Text Books:

1. G. D. Rai, 'Non-Conventional Energy Sources', Khanna Publisher
2. S. P. Sukhatme, 'Solar Energy: Principles of thermal collections and storage', McGraw Hill
3. Tiwari G N. 'Solar Energy: Fundamentals, design, modeling and Applications', Narosa, 2002

Reference Books :

1. Mukund R. Patel, 'Wind And Solar Power Systems: Design, Analysis and Operation, Second Edition', CRC Press
2. Kreith And Kreider, Solar Energy Handbook, McGraw Hill
3. Ray Hunter, 'Wind Energy Conversion: From Theory to Practice', John Wiley and Son Ltd
4. Gary L Johnson, 'Wind Energy Systems', Prentice-Hall Inc., New Jersey
5. Martin O L Hansen, 'Aerodynamics of Wind Turbines', James & James/Earthscan.
6. Goswami D Y, Kreith F, Kreider J F, 'Principles of Solar Engineering', Taylor & Francis
7. Robert Gasch, 'Wind Power Plant Fundamentals, Design, Construction And Operations', Springer
8. C S Solanki, 'Solar Photovoltaic: Fundamentals, Technology And Applications', PHI Learning

List of Practicals :

1: Design of solar food drier for domestic purpose referring existing system.
2: Design of parabolic dish solar cooker for domestic purpose.
3: Design and analysis of liquid flat plate type heater used in domestic purpose
4: Design of solar photovoltaic system for domestic/ commercial building purpose.
5. Case study on designing miniature wind mill for domestic purpose referring existing system.
6. Visit to solar PV system used in commercial building.
7. Visit to wind power system used in commercial building.

Course Coordinator: Dr. D.A.Kamble

BoS Member:

BoS Chairman:

Open Elective-I: Numerical Methods in Engineering (IOEUA42172D)

Teaching Scheme	Examination Scheme						
Credits: 3 Lecture (L): 2 hrs./week Tutorial (T): -- hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Prerequisite: Engineering Mathematics

Conrse Objectives:

To prepare the students to apply numerical methods to solve differential equations, integrations and simultaneous equations and perform regression analysis.

Conrse Outcomes:

Upon the completion of the course, students will be able to

I) Apply curve fitting techniques, carry out regression and interpolation analysis of any engineering problem.
2) Solve simultaneous equations using numerical technique.
3) Solve engineering problems using numerical integration.
4) Solve differential equation of any engineering problem using numerical technique.

Unit I: Curve Fitting, Regression and Interpolatiou

Curve fitting with Linear Equation, Criteria for a Best Fit, Linear Least Square Regression, Linear Regression Analysis, Coefficient of Determination, Polynomial Regression, Multiple Linear Regression, Lagrange's Interpolation, Newton's Forward Interpolation, Hermit Interpolation, Inverse Interpolation

Unit II: Simultaneons Eqnations

Gauss Elimination Method, Partial Pivoting, Gauss Seidel Method, Gauss Jordan Method and Thomas Algorithms for Tridiagonal Matrix.

Unit III: Numerical Integration

Trpezoidal rule, Simpson's Rule ($1/3^{rd}$ and $3/8^{th}$), Gauss Quadrature2 point and 3 point method, Double Integration- Trapezoidal Rule, Simpson's $1/3^{rd}$ Rule

Unit IV: Numerical Solntion of Differential Equatious

Euler Method, Modified Euler Method (Iterative), Runga-Kutta Fourth Order Method, Simultaneous Equations using Runga-Kutta Second Order Method, Introduction to Finite Difference Method.

List of Exercises: At least three assignments on each unit.

Text books:

1. Numerical methods- Rao V. Dukkipati- New Age International Publishers
2. Introductory Methods of Numerical Analysis- S.S.Sastry-University Press

Reference books:

1. Numerical Methods in Engineering with Python 3 – Jaan Kiusalaas-Cambridge University Press
2. Numerical Methods -S. Balachandra Rao and C.K.Shantha, University Press

Conrse Coordinator:

BoS Member:

BoS Chairman:

Open Elective-I: Social Media Analytics (IOEUA42172E)

Teaching Scheme	Examination Scheme						
Credits: 3 Lecture (L): 2 hrs./week Tutorial (T): --hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Prerequisites:

1. Basic knowledge of Graphs.
2. Data mining.
3. Data Analysis.

Course Objectives:

Upon successful completion of the course, students will be able to

1. Understand foundations of Social Media Analytics.
2. Visualize and understand the data mining aspects in social networks.
3. Solve mining problems by different algorithms.
4. Understand network measures for social data.
5. Understand behavioral part of web applications for Analysis.
6. Analyze the data available on any social media applications.

Course Outcomes:

By the end of the course, students should be able to

1. Explain the basics of Social Media Analytics.
2. State the visualization of social networks and the significance of Data mining in Social media.
3. Demonstrate the algorithms used for text mining.
4. Compare network measures for social media data.
5. Explain Behavior Analytics techniques used for social media data.
6. Apply social media analytics for Facebook, LinkedIn and Twitter kind of applications.

Unit I – Introductiou To Social Media Analytics (Sma) And Types Of Analytics Tools

Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas,

The foundation for analytics, Social media data sources, Defining social media data, data sources in social media channels, Estimated Data sources and Factual Data Sources, Public and Private data, data gathering in social media analytics

UNIT II - The Social Networks Perspective And Its Visnalization

The social networks perspective - nodes, ties and influencers, Social network and web data and methods. Graphs and Matrices- Basic measures for individuals and networks.

A Taxonomy of Visualization, The convergence of Visualization, Interaction and Analytics. Data mining in Social Media: Introduction, Motivations for Data mining in Social Media, Data mining methods for Social Media

Unit III – Text Mining In Sociai Networks

Introduction, Keyword search, Classification Algorithms, Clustering Algorithms-Greedy Clustering, Hierarchical clustering, k-means clustering, Transfer Learning in heterogeneous Networks, Sampling of online social networks, Comparison of different algorithms used for mining, tools for text mining.

Unit IV - Network Measures

Centrality: Degree Centrality , Eigenvector Centrality, Katz Centrality , PageRank, Betweenness Centrality, Closeness Centrality ,Group Centrality ,Transitivity and Reciprocity, Balance and Status, Similarity: Structural Equivalence, Regular Equivalence

Unit V – Behavior Anaiytics

Individual Behavior: Individual Behavior Analysis, Individual Behavior Modeling, Individual Behavior Prediction Collective Behavior: Collective Behavior Analysis, Collective Behavior Modeling, Collective Behavior Prediction

Unit VI - Case Study

Mining Twitter: Overview, Exploring Twitter's API, Analyzing 140 Characters
Mining Facebook: Overview, Exploring Facebook's Social Graph API's, Analyzing Social Graph Connections.
Mining Linked In: Overview, Exploring Linked In API

Text hooks :

1. Reza Zafarani Mohammad Ali Abbasi Huan Liu, Social Media Mining, Cambridge University Press, ISBN: 10: 1107018854.
2. Charu C. Aggarwal, Social Network Data Analytics, Springer, ISBN: 978-1-4419-8461-6.
3. Matthew Ganis, Avinash Kohirkar Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media,Pearson publications,2016

Reference Books :

1. Marshall Sponder, Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics, McGraw Hill Education, 978-0-07-176829-0. 2.
2. Matthew A. Russell, Mining the Social Web, O'Reilly, 2nd Edition, ISBN:10: 1449367615.
3. Jiawei Han University of Illinois at Urbana-Champaign Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann, 2nd Edition, ISBN: 13: 978-1-55860-901-3 ISBN: 10: 1-55860-901-6.
4. Bing Liu, Web Data Mining : Exploring Hyperlinks, Contents and Usage Data, Springer, 2nd Edition, ISBN: 978-3-642-19459-7

Conrsc Coordinator:

BoS Meinber:

BoS Chairman:

Open Elective-II: Financial Technology

Teaching Scheme	Examination Scheme						
Credits: 3 Lecture (L): 3 hrs./week Tutorial (T): - hr. Practical (P): - hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	-	100

Prerequisite: Readers/students are expected to know the following concepts:
Basics of Probability

Course Objectives:

- To Introduce FinTech and it's sub sectors
- To Explain the classification of various models of FinTech.
- To Describe the innovation in FinTech
- To Introduce an innovative Fin Tech strategy
- To Study the development of FinTech Application and about future trends in Fin Tech

Course Outcomes:
After completion of the course, student will be able to

1. Describe what FinTech is and the sub sectors that comprise it.
2. Classify various models of the Fintech
3. Illustrate various innovations done using latest technology trends in FinTech
4. State the Critical Success Factors in Fin Tech
5. Practice an innovative Fin Tech strategy within their own organization to lead a digital transformation project.
6. Develop the application using the concepts of FinTech as a case stud

Unit- I : Unit I: Introduction to Fintech
Introduction, Financial Services and Fintech: Introduction, Changing Environment, Customer Centricity, Digital Transformation, Definition of Fintech, History of Fintech, Fintech stages, An Overview of Fintech Initiatives Around the World, Ecosystems, Ranking National Ecosystems, Downsides of Disruptive Fintech Initiatives.

Unit-II : Model and Classifications
Introduction, Classification, Five Ws and one H : 1. Why a fintech initiative was born? 2. For whom was it born? 3. Which are the services it aims to provide? 4. Where does it aim to perform its business? 5. When does it aim to operate, within the framework of the financial cycle? 6. How is fintech working? The organization and its elements, The V4 business model framework, A Business Model, A Business Model for Fintech, Revenue—Focus on Customer Lifetime Value, Components of an effective marketing plan.

Unit III: Fintech Innovation

Introduction, Innovation and Fintech, Digital Transformation and Fintech, A model for an integrated innovation strategy, Types of Innovation : Product (or services), Process, Organization, Business models, Examples of Innovation, Fintech business model canvas, Process Innovation :

Big Data Analytics, Value Creation from Big Data Analytics, Kreditech's self-learning algorithm, Internet of Things, Blockchain Technology, Organizational Innovation: Social Networks, Business Model Innovation, Robots, The V4 business model framework for Kreditech, Virtual Currencies, Technology Acceptance Model.

Unit IV: Critical Success Factors

The Model, Low-Profit Margin, Agility, Scalability, Security Management, Innovation, Ease of Compliance, Metrics, Fintech and Financial Services, Structure of fintech initiatives, The Challenges, Aspects to Consider, A Cooperation Model, Open Innovation

Unit-V: Regulations

The Role of the Regulators, Equal Treatment and Competition, The Risks to Consider, Regtech, A Business Model for Insurtech Initiatives, Drivers of Disruption, The Impact of Technology, Insurance and Technology: Insurtech, Application of the Model to the Insurance Industry, The Empowerment of Customers, Mobility in Support of Insurance Companies, Digital Wholesale Insurance,

Unit VI: A Casc Study

Introduction, Robotica, Business Model Canvas, The Value Proposition, Customer Experience, Channels, Processes and Activities, Resources and Systems, Partnership and Collaborations, Revenues, Costs and Investments,

The Future: Financial Services as Platforms

Text Books :

1. B. Nicoletti, The Future of FinTech, 1st ed. Palgrave Macmillan, 2017
2. Kelvin Leong and Anna Sung "FinTech (Financial Technology): What is It and How to Use Technologies to Create Business Value in Fintech Way?" International Journal of Innovation, Management and Technology, Vol. 9, No. 2, April 2018.

Rcfercucc Books :

1. Accenture. (2015). The future of Fintech and banking: Digitally disrupted or reimagined? Accenture Research, 1–12
2. Dietz, M., Khanna, S., Olanrewaju, T., & Rajgopal, K. (2015). Cutting through the fintech noise: Markers of success, imperatives for banks. Practice, G. B. (Ed.), 1–18. McKinsey and Company. Retrieved from http://www.mckinsey.com/ industries/financial-services/our-insights/cutting-through-the-noise round financial -technology.
3. Nadar Naifar,"Impact of Financial Technology (FinTech) on Islamic Finance and Financial Stability" 2019.

Course Coordinator:

BoS Member:

BoS Chairman:

Open Elective-II: Agriculture Electronics (IOEUA42173B)

Teaching Scheme	Examination Scheme						
Credits: 3 Lecture (L): 3 hrs./week Tutorial (T): - hr. Practical (P): - hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	-	100

Prerequisite: Readers/students are expected to know the following concepts:

b. Basic Electronics devices and their operations
c. Basic understanding of sensors and transducers.
d. Basic Farming Activities.

Course Objectives:

- To empower the learner to recognize environmental problems and to provide solutions to agricultural sector.
- An over view of technology of advanced topics like DAS , SCADA and IOT .
- The ability to select the essential elements and practices needed to develop and implement the Engineering Automation for Agricultural sector.

Course Outcomes:

After completion of this course, students will be able to -

1. Explain Role of Instrumentation & DAS.
2. State basics of Sensors and transducers .
3. Describe Instrument technology used in agriculture.
4. Apply knowledge of Electronics to achieve Precision Farming.
5. Select system components for different control Farming applications
6. Describe Smart Agriculture Technology & Role of Electronics Governance

Unit I : Introduction of Iustrumentation system aud Data acquisitions systems (DAS)

Introduction of Instrumentation system, Block diagram,
Data loggers, Data acquisitions systems (DAS), Basics of PLC , Supervisory control and data acquisition (SCADA),

Unit II : Sensors and Transducers

Basic of sensors and transducers, Type of sensors, Performance terminology - Displacement, Velocity and Motion sensors - Proximity sensors, Force, Pressure,–
Soil parameter measurement sensors - Flow, Level and Temperature sensors , Humidity, pH and Conductivity sensors, Specifications and selection criteria.

Unit III : Instrument technology for agriculture

Instruments for measurement of pH, Electrical conductivity, gas analysis, humidity, leaf area, chlorophyll content, and soil moisture & temperature.
Instrument for crop monitoring – inoisture measurement – capacitive, infrared reflectance and resistance. Monitoring soil and weather – measurement of soil properties and meteorological parameters

Unit IV: Precision Farming
An introduction to precision farming. GIS/GPS positioning system for precision farming, Yield monitoring and mapping, soil sampling and analysis. Computers and Geographic information systems. Precision farming- Issues and conditions. Role of electronics in farm machinery for precision farming. Technology for precision farming.

Unit V: Control Applications in Farming :
Irrigation control systems. Instruments for crop establishment monitoring. Crop spraying – selective crop spraying – flow control. Yield monitoring.
Instruments for protected cultivation – Green house environment control – transducers and control system. Instruments and systems for crop handling processing and storage.

Unit VI: SMART agricnlture :
Introduction to IOT, IOT in Agriculture, Wireless sensor networks , IOT network using LoRaWAN.

Open Agriculture Initiative (OpenAg),

Agriculture & Electronics Governance: Technological Difficulties in Indian Context, Governance products & services in agriculture sector, Role of Electronics Governance in Agricultural sector.

Text Books :

1. **K. Krishua Swamy,** "Process Control"; New Age International Publishers.
2. C.S. Rangan, G.R. Sarma, V.S.V. Mani; " Instrumentation Devices and Systems "; Tata McGraw Hill; 2nd Edition
3. Curtis Johnson, "Process Control Instrumentation Technology"; 8th Edition, Pearson Education

Referenee Books :

4. Shimon Y. Nof , "Springer Handbook of Automations", Springer.
5. Ernest O. Doebelin; " Measurement System Application and Design "; Mc-Graw Hill; 5th Edition
6. David G. Alciatore, Michael B Histand; " Introduction to Mechatronics and Measurement System "; Tata McGraw Hill
7. De Mess M. N. Fundamental of Geographic Information System. John Willy & sons, New York, Datta S.K.1987

Course Coordiuator:

BoS Member:

BoS Chairman:

Open Elective-II: Operations Research (IOEUA42173C)

Teaching Scheme	Examination Scheme						
Credits: 3 Lecture (L): 3 hrs./week Tutorial (T): - hr. Practical (P): - hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	-	100

Prerequisite: Engineering Mathematics

Course objectives:

- To familiarize the students with various tools of optimization, probability and statistics as applicable scenarios in industry for better management of various resources

Course Outcomes:

By the end of the course, students will be able to

1. Solve linear programming problems using appropriate techniques
2. State the best strategy using decision making methods under uncertainty and game theory
3. Apply the concept of transportation/assignment models to optimize available resources
4. Develop mathematical skill to solve inventory and replacement problems
5. Illustrate minimization of process time
6. Use CPM and PERT techniques, to plan, schedule, and control project activities.

Unit I - Introduction to Operations Research

Introduction to Operations Research: Basics definition, scope, objectives, phases, models and limitations of Operations Research.

Linear Programming Problem: Formulation of LPP, Graphical solution of LPP. Simplex Method, Artificial variables, Two-phase method, Duality

Unit II – Decision Theory and Theory of Games

Decision Theory: Meaning and Steps in Decision Making, Types of Management Decisions, Decision under Certainty, Decision under Risk, Decision under Uncertainty, Decision Trees

Theory of Games: Introduction, Minimax and Maximin Principle, Solution of Game with Saddle Point, Solution by Dominance, Solution by Graphical Method, m x n size Game Problem

Unit III – Transportation and Assignment Model

Transportation Model: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: the stepping stone method and MODI method.

Assignment model: Formulation. Hungarian method for optimal solution. Solving unbalanced problem

Unit IV – Inventory Coutrol and Replacement Aualysis

Inventory Control: Basic Concepts, fixed order quantity inventory model, economic order quantity inventory models, probabilistic inventory model

Replacement Analysis: Replacement of Items that Deteriorate, Replacement of Items that Fail Suddenly: Individual replacement policy, Group replacement policy.
Unit V – Queuing Theory and Sequencing Model
Queuing Theory: Introduction, Basis Structure, Terminology (Kendal's Notations), Queuing Model M/M/1: /FIFO, M/M/c. Sequencing models: Solution of sequencing Problem - Processing of n jobs through two machines, Processing of n jobs through three machines, Processing of two jobs through m Machines, Processing of n jobs through m Machines.
Unit VI – Project Management
Fundamentals of CPM and PERT networks, CPM: Construction of networks, Fulkerson's rule , Critical paths, Forward and backward pass, Activity Float analysis, Crashing Analysis, PERT: Time estimates, Construction of networks, Probability of completing projects by given date.

Text Books:

4. Sharma S.D., "Operations Research", Kedarnath Ramnath and company publications. ISBN-I3:1234567142552
5. Gupta P.K., Hira D.S., "Operations Research", S Chand and Co. Ltd., New Delhi. ISBN 13:9788121902816
6. Taha H.A., "Operations Research - An introduction", Prentice Hall Pvt. Ltd. ISBN-13: 978-0132555937

Reference Books:

1. Hillier F.S., Lieberman G.J., "Introduction to Operations Research", Tata McGraw-Hill. ISBN 978-0-07-337629-5
2. Wagner H.M., "Principles of Operations Research", Prentice-Hall India ISBN 978-0-9843378-2-8
3. Ravindran A., "Operations Research", Tata McGraw-Hill. New Delhi ISBN-13: 978-0471086086
4. Basu S.K., Pal D.K., and Bagchi H., "Operations Research for Engineers", Oxford and IBH Publishiug ISBN 81-204-1251-6
5. Panneerselvam R., "Operations Research", Prentice Hall of India Ltd., New Delhi ISBN 81-203-1923-0

Course Coordinator: Prof. P.R. Anerao

BoS Member:

BoS Chairmau:

Open Elective-II: Total Qnality Management (IOEUA42173D)

Teaching Scheme	Examlnation Scheme						
Credits: 3 Lecture (L): 3 hrs./week Tutorial (T): - hr. Practical (P): - hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	-	100

Prerequisite:

Course Objectives:
To introduce the basic concepts of Quality management System and Management Information System

Course Outcomes:
Upon the completion of the course, students will be able to,
1. Explain the aspects of Quality in Construction activity
2. Explain the application of Six Sigma and Seven Quality tools in the Total Quality Management
3. Explain the role of Quality Manual to monitor Total Quality Management System
4. Describe the aspects of benchmarking and certifications
5. Explain the techniques of TQM implementation and awards
6. State the aspects of Management Information System

Unit I: Quality in Construction

Quality – Various definitions and interpretation. Importance of quality on a project in the context of global challenges, Factors affecting quality of construction, Reasons for poor quality and measures to overcome, Contribution of various Quality Gurus (Juran, Deming, Crossby, Ishikawa), Evolution of TQM- QC, TQC, QA, QMS, TQM.

Unit II: TQM & Six Sigma

TQM – Necessity, advantages , 7QC tools, Quality Function Deployment(QFD), Six sigma – Importance, levels, Defects & it's classification in construction. Measures to prevent and rectify defects.

Unit III: ISO & Quality Manual

Study of ISO 9001 principles. Quality manual – Importance, contents, documentation. Importance of check-lists in achieving quality. Typical checklist for concreting activity, formwork activity, steel reinforcement activity. Corrective and Preventive actions, Conformity and NC reports

Unit IV: Management Control & Certificatious

Benchmarking in TQM, Kaizen in TQM. Quality Circle. Categories of cost of Quality. CONQAS, CIDC-CQRA certifications.

Uuit V: Techniques iu TQM Implementation and awards

5 _S' techniques. Kaizen. Failure Mode Effect Analysis (FMEA). Zero Defects. National & International quality awards- Rajeev Gandhi Award, Jamuna lal Bajaj Award, Golden Peacock Award, Deming Prize,

Malcolm Baldrize award.

Unit VI: Management Information Systeni
Introduction to Management Information systems (MIS) Overview, Definition. MIS and decision support systems, Information resources, Management subsystems of MIS, MIS based on management activity whether for operational control, management control, strategic control. Study of an MIS for a construction organization associated with building works.
Text books: 1. Total Quality Management-- Dr. Gunmala Suri and Dr. Puja Chhabra Sharma—Biztantra. 2. Quality Control and Total Quality Management by P.L.Jain- Tata McGraw Hill Publ. Company. 3. Total Quality Management - Dr. S.Rajaram and Dr. M. Sivakumar—Biztantra. 4. Total Engineering Quality Management – Sunil Sharma – Macmillan India Ltd.
Refereuce books: 1. Juran's Quality Handbook – Juran Publication. Importance of quality on a project in the context of global challenges. Importance of quality on a project in the context of global challenges. 2. Management –Principal, process and practices by Bhat – Oxford University Press. 3. Financial management by Shrivastava- Oxford University Press. 4. Management Information Systems – Gordon B. Davis, Margrethe H. Olson – Tata McGraw Hill Publ. Co. 5. Total Project Management – The Indian Context - P.K.Joy Macmillan India Ltd.
E- Sources: www.nptel.ac.in , www.mobile.enterpriseappstoday.com

Course Coordinator:

BoS Member:

BoS Chairmau:

Open Elective-II: Blockchain Technologies (IOEUA42173E)

Teaching Seheme	Examination Scheme						
Credits: 3 Lecture (L): 3 hrs./week Tutorial (T): - hr. Practical (P): - hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	-	100

Prereqnisites:

- **Nil**

Conrse Objectives:

- To understand the basic fundamentals of Blockchain
- To introduce Bitcoin Blockchain
- To explain blockchain creation process
- To know the importance of Hyperledger
- To gain knowledge about the multichaining
- To discuss the emerging trends in Blockchain and Use cases

Course Outcomes:

After completion of the course, student will be able to

1. Demonstrate fundamental knowledge of Blockchain
2. Explain Bitcoin Blockchain
3. Describe blockchain creation process
4. Explain Hyperledger
5. Describe Emerging Trends in Blockchain

Unit I :	**Overview of Biockchain**
Basics of Blockchain, History of Blockchain, Network and protocols, Smart Contract and Consensus Algorithms, Blockchain users and adoption, Blockchain challenges	
Unit II :	**Bitcoin Blockchain**
Blockchain TOC Bitcoin/ Blockchain data structures, Keys as identity, Digital Signatures, Hashes, Hashes as Addresses, Hash Pointers and Data Structures, Blockchain transactions, Blockchain block structure	
Unit III :	**Creating the Blockchain: Mining**

Mining explained, The bitcoin network, The bitcoin Minning Process, Minning Developments	
Unit IV :	**Hyperledger**
Overview of Hyperledger, Hyperledger Projects, Hyperledger Architecture, Consensus model for permissioned Blockchains, Consensus and its interaction with architectural layers, Architecture of Enterprise level Blockchain applications.	
Unit V :	**Blockchain on Mnltichain**
Introduction to Multichain, Privacy and Permissions in Multichain, Features of Assets in Multichain, Multichain Streams, Mining in Multichain, Interactive mode commands, Round Robin Mining	
Unit VI :	**Emerging Trends In Bloekchain and Use cases**
Transaction limitations, Additional blockchains. Hyperledger, Ethereum, Ripple, R3, Blockchain and cloud computing, Cloud -Based Blockchains, Blockchain Use cases, Blockchain and Artificial Intelligence.	
Text Books :	
1	Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos
2	Blockchain by Melanie Swa, O'Reilly
3	Hyperledger Fabric - https://www.hyperledger.org/projects/fabric
Reference Books :	
1	Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits - https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html

Course Coordinator:

BoS Member:

BoS Chairman:

Introdnction to Research (MEUA42174)

Teaching Scheme	Examination Scheme						
Credits: 2 Lecture (L): 1 hrs./week Tutorial (T): -- hr. Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	-	-	-	-	-	25	25

Course objectives:

- To understand concepts of hypothesis.
- Able to formulate a research problem with the methodology
- To study statistical techniques and its applications in research.

Course ontcomes:

Upon successful completion of this course, students will be able to

1. Explain Significance and approaches for research.
2. Explain concept and procedure of hypothesis testing.
3. Develop capability to undertake empirical and quantitative research with software using scientific methods.
4. Write technical reports in standard format.

Unit I : Introduction to Research Methodology

Meaning and purpose of research, Objective of research, Types of research, Significance and approaches for research, Research Process and criteria, Scientific methods, Meaning of Research problem, Identification, selection and formulation of Research Problem, Meaning of Research Design, Need of Research Design, Features of a Good Research Design, Different types Research Desig

Unit II : Hypothesis and Basic Instrumentation

What is Hypothesis? Concept and procedure of Hypothesis Testing, Flow diagram and test for Hypothesis.

Instrumentation schemes, Static and dynamic characteristics of instruments used in experimental set up, Performance under flow or motion conditions, Data collection using a digital computer system, Linear scaling for receiver and fidelity of instrument, Role of DSP is collected data contains noise

Unit III : Introdnction to Applied Statistics, Modeliing and Prediction of Performance

Regression analysis, Parameter estimation, Multivariate statistics, Principal component analysis, Moments and response curve methods, State vector machines and uncertainty analysis, Probable errors in the research, Error analysis

Setting up a computing model to predict performance of experimental system, Multi-scale modelling and verifying performance of process system, Nonlinear analysis of system and asymptotic analysis, Verifying if assumptions hold true for a given apparatus setup, Plotting family of performance curves to study trends and tendencies, Sensitivity theory and applications.

Unit IV : Deveioping a Research Proposai

Format of research proposal, Individual research proposal, Institutional proposal, Proposal of a student – a presentation and assessment by a review committee consisting of Guide and external expert only, Other faculty members may attend and give suggestions relevant to topic of research.

Text Books :

1. Research Methodology: A Step by Step Guide for Beginners, Ranjit Kumar, 2nd Edition
2. Research Methodology: Methods and Trends, Dr. C. R. Kothari
3. Operational Research, Dr. S.D. Sharma, Kedar Nath Ram Nath& co.

Reference Books :

1. Research methodology: an introduction for science & engineering students, Stuart Melville and Wayne Goddard
2. Research Methodology: An Introduction, Wayne Goddard and Stuart Melville

Term Work :

Write Sample research proposal of the planned research topic giving details of topic, significance, funding required etc and verify the research article for plagiarism and attach the plagiarism report

Course Coordinator: Dr.D.N.Kamble

BoS Member:

BoS Chairman: