

PAAVAI ENGINEERING COLLEGE (AUTONOMOUS)
B.E. SAFETY AND FIRE ENGINEERING
REGULATIONS – 2019 (CBCS)
CURRICULUM
SEMESTER I

S.No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	HS	EN20101	English Communication Skills I	3	0	0	3
2	BS	MA20101	Matrices and Calculus	3	1	0	4
3	BS	PH20101	Engineering Physics	3	0	0	3
4	BS	CH20101	Engineering Chemistry	3	0	0	3
5	ES	EE20101	Basic Electrical Engineering	3	0	0	3
6	ES	ME20101	Engineering Graphics	2	1	0	3
Practical							
7	BS	CH20102	Chemistry Laboratory	0	0	2	1
8	ES	GE20101	Engineering Practices Laboratory	0	0	4	2
Total				17	2	6	22

SEMESTER II

S.No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	HS	GE20202	தமிழர்மரபு / Heritage of Tamils	1	0	0	1
2	HS	EN20201	English Communication Skills II	3	0	0	3
3	BS	MA20201	Complex Variables and Differential Equations	3	1	0	4
4	BS	PH20203	Material Science	3	0	0	3
5	ES	CS20201	Programming in Python	3	0	0	3
6	PC	ME20202	Engineering Mechanics	3	1	0	4
7	MC	MC20201	Environmental Science and Engineering	3	0	0	0
Practical							
8	BS	PH20205	Physics Laboratory	0	0	2	1
9	ES	CS20202	Programming in Python Laboratory	0	0	2	1
Total				19	2	4	20



SEMESTER III

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	HS	GE20301	தமிழரும் தொழில்நுட்பமும் / Tamil and Technology	1	0	0	1
2	BS	MA20301	Transforms and Boundary Value Problems	3	1	0	4
3	ES	ME20304	Fluid Mechanics and Hydraulic Machines	3	0	0	3
4	PC	SF20301	Principles of Safety Management	3	0	0	3
5	PC	SF20302	Principles of Chemical Engineering	3	0	0	3
6	PC	EE20313	Electrical Technology and Safety	3	0	0	3
7	MC	MC20301	Value Education	2	0	0	0
Practical							
8	ES	ME20306	Fluid Mechanics and Machinery Laboratory	0	0	2	1
9	PC	EE20314	Electrical Technology Laboratory	0	0	2	1
10	EE	EN20301	English Proficiency Course Laboratory	0	0	2	1
Total				18	1	6	20

SEMESTER IV

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	BS	MA20401	Statistics and Numerical Methods	3	1	0	4
2	PC	SF20401	Occupational Health and Hygiene	3	0	0	3
3	PC	SF20402	Strength of Materials	3	0	0	3
4	PC	SF20403	Fire Engineering and Protection	3	0	0	3
5	PC	SF20404	Safety in Construction	3	0	0	3
6	PC	SF20405	Metrology and Measurements	3	0	0	3
Practical							
7	PC	SF20406	Industrial Hygiene Laboratory	0	0	2	1
8	PC	SF20407	Metrology and Measurements Laboratory	0	0	2	1
9	PC	ME20407	Strength of Materials Laboratory	0	0	2	1
Total				18	1	6	22



அலகு I

மொழி மற்றும் இலக்கியம்

3

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி- தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள் தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II

மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை

3

நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம், - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III

நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்

3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியன் கூத்து, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு IV

தமிழர்களின் திணைக் கோட்பாடுகள்

3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அறம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறைமுகங்களும் - சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V

இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத்
தமிழர்களின் பங்களிப்பு

3

இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்கள் அச்சு வரலாறு.

TOTAL PERIODS: 15

TEXT CUM REFERENCE BOOKS:

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே.பிள்ளை. (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணிணித் தமிழ் – முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு).
4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A Joint publication of TNTB & ESC and RMRL – (in print).
6. Social Life of the Tamils – The Classical Period (Dr.S.Singaravelu) (Published by International institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subramanian, Dr.K.D.Thirunavukkarasu)
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by International institute of Tamil Studies)
9. Keeladi – ‘Sangam City Civilization on the banks of river vaigai’ (Jointly Published by Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by the author)
11. Porunai Civilization (Jointly Published by Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamilnadu).
12. Journey of Civilization Indus to vaigai (R.Balakrishnan) (Published by RMRL) – Reference Book



GE20202

HERITAGE OF TAMILS

L P T C

1 0 0 1

UNIT I

LANGUAGE AND LITERATURE

3

Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – 3
SCULPTURE

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhngam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT III FOLK AND MARTIAL ARTS

3

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV THINAI CONCEPT OF TAMILS

3

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL 3
MOVEMENT AND INDIAN CULTURE

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL PERIODS: 15

TEXT CUM REFERENCE BOOKS:

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே.பிள்ளை. (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு).

4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A Joint publication of TNTB & ESC and RMRL – (in print).
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7. Historical Heritage of the Tamils (Dr.S.V.Subramanian, Dr.K.D.Thirunavukkarasu)
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9. Keeladi – ‘Sangam City Civilization on the banks of river vaigai’ (Jointly Published by Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by the author)
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12. Journey of Civilization Indus to vaigai (R.Balakrishnan) (Published by RMRL) – Reference Book



MA20301

TRANSFORMS AND BOUNDARY VALUE PROBLEMS

3 1 0 4

(Common to Aero, Agri, Chemical, EEE, Civil, Food, IT, Mech, MCT, Pharma, Robotics, Safety & Fire, Bio-Tech)

OBJECTIVES

To enable the students to

- introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems
- acquaint the students with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic
- formulate Partial Differential Equations and use Mathematical tools for the solution of PDE that model several physical processes
- develop the modeling of one dimensional equation of heat conduction, wave equation and two dimensional Laplace equation
- develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform does for continuous systems, a valuable aid in analysis of continuous time systems

UNIT I FOURIER SERIES 12

Dirichlet's conditions; General Fourier series; Odd and even functions; Half range series; Complex form of Fourier Series; Parseval's identity; Harmonic Analysis.

UNIT II FOURIER TRANSFORMS 12

Fourier integral theorem (without proof); Fourier transform pair; Convolution theorem; Parseval's identity; Sine and Cosine transforms - Properties; Transforms of elementary functions.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations; Lagrange's linear equation; Solutions of four standard types of first order partial differential equations; Linear partial differential equations of second order with constant coefficients.

UNIT IV FOURIER SERIES SOLUTION TO PARTIAL DIFFERENTIAL EQUATIONS 12

Solutions of One-dimensional wave and heat equation; Steady state two-dimensional heat equation.

UNIT V Z -TRANSFORMS AND DIFFERENCE EQUATIONS 12

Z-transforms - Elementary properties; Inverse Z-transform; Convolution theorem; Formation of difference equations; Solution of difference equations using Z-transform.

TOTAL PERIODS: 60



OUTCOMES

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

- derive Fourier series, their possible forms of representations of periodic functions
- identify and formulate a function in frequency domain whenever the function is defined in time domain
- formulate and solve partial differential equations that occur in many engineering applications
- model wave and heat equations, solve certain boundary value problems and use the solution methods in engineering applications.
- demonstrate the use of Z-transform to convert discrete functions into complex frequency domain representation

TEXT BOOKS

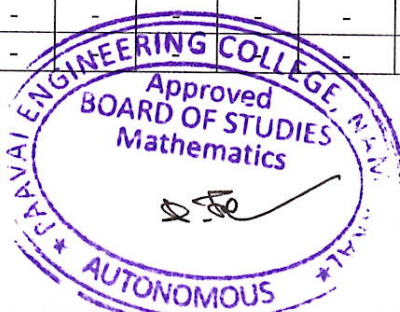
1. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications, Delhi,(2011).

REFERENCE BOOKS

1. Narayanan S., Manickavasagam Pillai.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" ,Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.
2. Larry C. Andrews, Bhimsen K. Shivamoggi, "Integral Transforms for Engineers", SPIE Optical Engineering press, Washington USA (1999).
3. Ramana. B.V., "Higher Engineering Mathematics", Tata Mc-GrawHill Publishing Company limited, New Delhi (2010).
4. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education (2007).
5. Erwin Kreyszig., "Advanced Engineering Mathematics" 10th Edition, Wiley Publications.

CO/PO Mapping

Mapping of Course Outcomes with Programme Outcomes (3/2/1 indicates strength of correlation) 3- Strong, 2-Medium, 1-Weak														
CO	Programmes Outcomes(POs)												PS O1	PS O2
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		
CO1	3	3	2	2	-	-	-	-	-	-	-	1	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	1	-	-
CO3	3	2	3	2	-	-	-	-	-	-	-	1	-	-
CO4	3	2	2	2	-	-	-	-	-	-	-	1	-	-
CO5	3	3	2	2	-	-	-	-	-	-	-	1	-	-



COURSE OBJECTIVES

To enable the students to

- gain knowledge of fluid, its properties and behavior under various conditions.
- apply Bernoulli's equation to various flow measuring devices.
- evaluate the fluid velocity considering major and minor losses.
- emphasize the boundary layer concepts and importance of dimensional analysis.
- comprehend the functioning and characteristic curves of pumps and turbines.

UNIT I FLUID PROPERTIES AND FLUID STATICS 9

Fluid definition and Classification; Properties of fluids - Density, Specific volume, Specific gravity, Specific weight, Viscosity, Compressibility, Bulk modulus, Capillarity and Surface tension; Forces on immersed surfaces; Introduction about center of pressure and buoyancy; Pressure Measurement - Piezometer, U-tube and Differential Manometers.

UNIT II KINEMATICS AND DYNAMICS OF FLUID FLOW 9

Kinematics of flow - Types of fluid flow, Continuity equation in two and three dimensions; Velocity and acceleration of fluid particle; Velocity potential function and Stream function; Dynamics of flow - Euler's equation of motion, Bernoulli's equation, Applications, Venturimeter, Orificemeter and Pitot tube.

UNIT III FLOW THROUGH PIPES 9

Reynold's experiment; Laminar flow through circular pipe (Hagen Poiseulle's equation); Flow through pipes - Loss of head due to friction, Minor head losses, Flow through pipes in series and in parallel, Hydraulic gradient and Total energy lines.

UNIT IV FLUID FLOW OVER BODIES AND DIMENSIONAL ANALYSIS 9

Boundary layer concepts - Types of boundary layer, Boundary layer thickness; Need for dimensional analysis - Methods of dimensional analysis using Buckingham's π theorem; Similitude - Types of similitude.

UNIT V HYDRAULIC PUMPS AND HYDRAULIC TURBINES 9

Centrifugal pumps - Classifications, Working principle, Velocity triangles, Work done by the impeller; Reciprocating pumps - Classifications, Working Principle (Theory only); Turbines - Classification of turbines, Pelton wheel, Francis turbine, Working principles, Velocity triangles, Work done by water on the runner.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

- apply the knowledge of various fluid properties at rest and in transit.
- utilize the Bernoulli's equation to various fluid flow to kinematics and dynamics of fluid flow.
- analyze the friction losses of fluid while flowing through a pipe to pipeline network.

- illustrate the boundary layer concepts and dimensional analysis.
- evaluate the performance aspects of fluid machinery for centrifugal pump and turbines.

TEXT BOOKS

1. Bansal, R.K., Fluid Mechanics and Hydraulics Machines, Laxmi Publications (P) Ltd., 9th Edition, New Delhi, 2017.
2. Rajput R.K., “A text book of Fluid Mechanics and Hydraulic Machines” S.Chand& Company Ltd. 6th Edition , New Delhi. 2019.

REFERENCES

1. Kumar. K.L., Engineering Fluid Mechanics Eurasia Publishing House (P) Ltd., 8th Edition, New Delhi, 2016.
2. Rathakrishnan. E., Fluid Mechanics:An Introduction, Prentice Hall of India Pvt. Ltd, 3rd Edition, 2012.
3. Som S.K., BiswasG., “Introduction to Fluid Mechanics and Fluid Machines”, Tata McGraw Hill Education Pvt. Ltd, 4th Edition New Delhi, 2019.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak														
COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	2	2	2
CO2	3	2	3	2	-	-	-	-	-	-	-	2	2	2
CO3	3	3	3	2	-	-	-	-	-	-	-	2	2	2
CO4	3	3	3	2	-	-	-	-	-	-	-	2	2	2
CO5	3	3	3	2	-	-	-	-	-	-	-	2	2	2



SF20301

PRINCIPLES OF SAFETY MANAGEMENT

3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the principles of safety management.
- learn about various functions and activities in organization
- conduct safety audit and write audit report effectively in auditing situations.
- gain knowledge about sources of information for safety promotion and training.
- familiarize with evaluation of safety performance.

UNIT I INTRODUCTION AND NEEDS OF SAFETY

9

Introduction-Safety-Goals of safety engineering. Need for safety. Safety and productivity .Definitions: Accident, Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents. Theories of accident causation.

UNIT II SAFETY ORGANIZATION INTRODUCTION

9

Safety organization- objectives, types, functions, Role of management, supervisors, workmen, unions, government and voluntary agencies in safety. Safety policy. Safety Officer- responsibilities, authority. Safety committee-needs, types, advantages. Accident prevention Methods-Engineering, Education and Enforcement.

UNIT III SAFETY EDUCATION AND TRAINING

9

Safety Education & Training-Importance, Various training methods, Effectiveness of training, Behavior oriented training. Communication- purpose, barrier to communication. Housekeeping: Responsibility of management and employees. Advantages of good housekeeping .5s of housekeeping. Works permit system-objectives, hot work and cold work permits. Typical industrial models and methodology. Entry into confined spaces.

UNIT IV SAFETY PERFORMANCE MONITORING

9

Personal protection in the work environment, Types of PPEs, Personal protective equipment-respiratory and non-respiratory equipment. Standards related to PPEs. Monitoring Safety Performance: Frequency rate, severity rate, incidence rate, activity rate. Cost of accidents –Computation of Costs-Utility of Cost data. Plant safety inspection, types, inspection procedure. Safety sampling techniques. Job safety analysis (JSA), Safety surveys, and Safety audits. Safety Inventory Technique.

UNIT V ACCIDENT INVESTIGATION AND REPORTING

9

Accident investigation- Why? When? Where? Who? and How? Basics- Man- Environment and Systems. Process of Investigation -Tools-Data Collection- Handling witnesses- Case study. Accident analysis- MORT-Multi Events Sequencing-TOR.

TOTAL PERIODS : 45

COURSE OUTCOMES

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

- understand the functions and activities of safety engineering department
- carry out a safety audit and prepare a report for the audit.
- prepare an accident investigation report.
- estimate the accident cost using supervisors report and data.
- identify various agencies, support in situations and government organizations involved in safety training and promotion

TEXT BOOKS

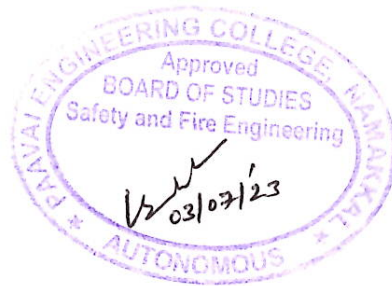
1. Heinrich H.W. "Industrial Accident Prevention" McGraw- Hill Company, New York, 1969, 4th Edition
2. Krishnan N.V. "Safety Management in Industry" Jaico Publishing House, Bombay, 1997

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1. Krishnan, N.V. (1997). Safety management in Industry .Jaico Publishing House, NewDelhi.
2. John V. Grimaldi and Rollin H. Simonds. (1989) Safety management, All India Traveller Book Seller, Delhi.
3. Ronald Blake. (1973). Industrial safety. Prentice Hall, NewDelhi.
4. Alan Waring. (1996). Safety management system. Chapman & Hall, England.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	-	-	3	-	2	3	1	2	-	-	-	1	1	1
CO2	-	-	3	-	2	3	2	2	-	-	-	1	1	1
CO3	-	-	2	-	1	3	1	1	-	-	-	1	1	1
CO4	-	-	3	-	2	2	1	1	-	-	-	1	1	1
CO5	-	-	2	-	1	1	2	1	-	-	-	1	1	1



COURSE OBJECTIVES

To enable the students to

- understand the overall significance of the chemical engineering
- gain knowledge on basic components of chemical engineering.
- learn about concept unit process and unit operations.
- familiarize with modern chemical engineering and its scope in various fields.
- know about recent developments in chemical engineering.

UNIT I SIGNIFICANCE

9

Chemistry, Chemical Engineering and Chemical Technology; Chemical process industries: History and their role in Society ;Role of Chemical Engineer; History and Personalities of Chemical Engineering; Greatest achievements of Chemical Engineering.

UNIT II DIFFERENT COMPONENTS

9

Components of Chemical Engineering: Role of Mathematics, Physics, Chemistry and Biology; Thermodynamics, Transport Phenomena, Chemical Kinetics and Process dynamics, design and control.

UNIT III UNIT PROCESSES AND UNIT OPERATIONS

9

Concept of Unit Processes and Unit Operations; Description of different Unit Processes and Unit Operations; Designing of equipment's; Flow sheet representation of process plants, Evolution of an Industry – Sulphuric acid and Soda ash manufacture. Demonstration of simple chemical engineering experiments; Plant visit to a chemical industry.

UNIT IV MODERN APPROACH

9

Role of Computer in Chemical Engineering; Chemical Engineering Software; Visit to Process Simulation Lab; Relation between Chemical Engineering and the reengineering disciplines; Traditional vs. modern Chemical Engineering; Versatility of Chemical Engineering; Role of Chemical Engineers in the area of Food, Medical, Energy, Environmental, Biochemical, Electronics etc. Plant visit to an allied industry.

UNIT V NEW DEVELOPMENTS

9

Paradigm shifts in Chemical Engineering; Range of scales in Chemical Engineering; Opportunities for Chemical Engineers; Future of Chemical Engineering.

TOTAL PERIODS : 45**COURSE OUTCOMES**

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

- discuss the concept of chemical engineering principles
- analysis the role of basic sciences in chemical engineering.
- design equipment and explain simple chemical engineering experiments.

- use simulation in chemical engineering for applying in various fields.
- knowledgeably discuss opportunities and future of chemical engineering

TEXT BOOKS

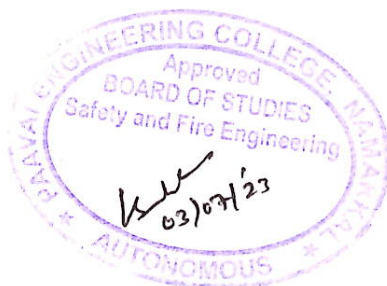
1. SalilK. Ghosal, Siddhartha Datta "Introduction to Chemical Engineering" Tata McGraw-Hill Education.
2. BadgerW.L. and Banchero J.T., "Introduction to Chemical Engineering", 6th Edition, Tata McGrawHill, 1997

REFERENCES

1. Dryden, C.E., "Outlines of Chemicals Technology", Edited and Revised by Gopala Rao,M. and M.Sittig, 2nd Edition, Affiliated East-Westpress,1993.
2. Randolph Norris Shreve, George T.Austin, "Shreve'e Chemical Process Industries", 5th edition, McGrawHill,1984.
3. Finlayson,B.A., Introduction to Chemical Engineering Computing, John Wiley & Sons, NewJersey, 2006.
4. McCabe,W.L.,Smith,J.C. and Harriot,P. "Unit operations in Chemical Engineering", McGrawHill, 7th Edition, 2007.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak														
COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO3	2	1	3	-	-	-	-	-	-	-	-	1	3	3
CO4	2	1	1	-	1	1	1	-	-	-	-	1	2	1
CO5	2	1	-	-	-	-	-	-	-	-	-	1	-	-



COURSE OBJECTIVES

To enable the students to

- acquaint basic knowledge on DC machines and transformer construction and working principle.
- impart knowledge on the working and characteristics of synchronous machines and induction motor.
- study the concept of arc phenomenon and different types of relay circuits.
- identify the safety measures during installation, testing and commissioning of electrical equipment's.
- learn the different types of fire safety equipment's and static electricity.

UNIT I DC MACHINES AND TRANSFORMERS 9

DC Machines – Construction, EMF equations, characteristics of generator, losses and efficiency; Transformer – Construction, EMF equation, operation of transformer under no load and load condition, equivalent circuit, voltage regulation, losses and efficiency in transformer.

UNIT II SYNCHRONOUS MACHINES AND INDUCTION MOTOR 9

Synchronous machines – Construction, EMF equation, rotating magnetic field, armature reaction, voltage regulation, losses and efficiency, power and torque, speed torque characteristics; Three phase induction motor – Construction, principle of operation, EMF and current relations.

UNIT III CIRCUIT BREAKERS, RELAYS AND GROUNDING 9

Circuit breakers - Arc phenomenon, principles of arc extinction, methods of arc extinction; Relays - Fundamental requirements of protective relaying, electromagnetic attraction relays, electromagnetic induction relays; Relay types – Distance relays, differential relays; Equipment grounding; System grounding; Ungrounded neutral system; Neutral grounding – Methods of neutral grounding.

UNIT IV SAFETY DURING INSTALLATION, TESTING AND COMMISSIONING, OPERATION AND MAINTENANCE 9

Safety during installation of plant and equipment - Safe sequences in installation, risk during installation; Safety during testing and commissioning; Test on relays - Protection and interlock systems for safety; Hazardous zones - Classification of hazardous zones, intrinsically safe and explosion proof electrical apparatus, selection of equipment's in hazardous area; Electrical fires - Hazards of static electricity; Safe procedures for electrical maintenance - Statutory requirements; Safety provisions in Indian electricity act and rules.

UNIT V ELECTRICITY AND FIRE SAFETY 9

Power factor improvement - Importance of power factor improvement, disadvantages of low power factor, causes of low power factor; Personal protective equipment (PPE) used in connection with safe use of electricity like hand gloves, rubber shoes, waist belt, earthing rod, goggles; Safe working

clearances for different voltage levels; Fire extinguishers used for different applications; Knowledge of static electricity; Lightning protection; Electrical safety audit; Elementary knowledge of first aid.

TOTAL PERIODS: 45

COURSE OUTCOMES

At the end of this course, students will be able to

- recapitulate the construction and operation of DC machines and transformers.
- describe the characteristics and operation of synchronous machines and induction motor.
- analyze the different types of protective relays and methods of grounding.
- explain the safety during electrical equipment installation and commissioning.
- enumerate the knowledge on fire safety needs for electrical equipment's.

TEXT BOOKS

1. C.L.Wadhwa, "Basic Electrical Engineering", New Age International Publishers, Fourth Edition, Reprint 2021.
2. S.Rao, R.K.Jain, H.L.Saluja, "Electrical Safety, Fire Safety Engineering and Safety Management", Khanna Publishers, Second edition, Reprint 2012.

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1. V.K. Mehta, Rohit Mehta, "Principles of Power System", S.Chand Publishing Company, Fourteenth Edition, 2022.
2. W Fordham Cooper, "Electrical Safety Engineering", Butterworth-Heinemann Ltd., Fourth Edition, 2013
3. S.K.Bhattacharya, "Basic Electrical and Electronics Engineering", Pearson Education India, Second edition, 2017.
4. J. Maxwell Adams, "Electrical Safety", The Institution of Engineering and Technology, First Edition, Reprint 2016.

CO-PO MAPPING

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
CO's	Programme Outcomes PO's												PSO's	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	1	-	-	1	-	-	-	-	1	2	-	-
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CO3	3	1	2	-	-	2	-	-	-	-	-	2	-	-
CO4	3	1	1	-	-	1	-	-	-	-	-	3	-	-
CO5	3	-	-	-	-	1	-	-	-	-	-	3	-	-



COURSE OBJECTIVES

To enable the students to

- develop the individual multi-dimensionally in physical, intellectual, emotional and spiritual dimensions.
- facilitate individuals think about and reflect on different values.
- understand their responsibility in making choices and the practical implications of expressing them.
- instigate to choose their personal, social, moral and spiritual values.
- design and chisel the overall personality of an individual.

UNIT I PERSONAL VALUES**6**

Value Education – Definition, Types of values; Human values - Respect, Acceptance, Consideration, Appreciation, Listening, Openness, Affection, Patience, Honesty, Forgiveness, Sacrifice, Authenticity, Self Control, Altruism, Tolerance and Understanding, Wisdom, Decision making, Self–actualization, Character formation towards positive Personality, Contentment; -Religious Values -Humility, Sympathy and Compassion, Gratitude. Peace, Justice, Freedom, Equality.

UNIT II SOCIAL VALUES**6**

Social Values - Pity and probity - Self control - Respect to - Age, Experience, Maturity, Family members, Neighbours- Universal Brotherhood - Flexibility -Peer pressure - Sensitization towards Gender Equality, Physically challenged, Intellectually challenged - Reliability - Unity - Modern Challenges of Adolescent Emotions and behaviour - Comparison and Competition- Positive and Negative thoughts- Arrogance, Anger and Selfishness.

UNIT III ENGINEERING ETHICS**6**

Professional Values -.Knowledge thirst - Sincerity in profession- Regularity, Responsibility, Punctuality and Faith - Perseverance - Courage - Competence - Co-operation- Curbing unethical practices - Integrity, Social Consciousness and Responsibility. Global Values - Computer Ethics – Moral Leadership - Code of Conduct - Corporate Social Responsibility.

UNIT IV SPIRITUAL VALUES**6**

Developing Spirituality - Thinking process, Moralization of Desires - Health benefits- Physical exercises - Mental peace - Meditation - Objectives, Types, Effects on body, mind and soul- Yoga - Objectives, Types, Asanas. Family values -family's structure, function, roles, beliefs, attitudes and ideals, Family Work Ethic, Family Time, Family Traditions.

UNIT V HUMAN RIGHTS**6**

Classification of Human Rights - Right to Life, Liberty and Dignity- Right to Equality - Right against Exploitation - Cultural and Educational Rights- Physical assault and Sexual harassment - Domestic violence.

TOTAL PERIODS 30

COURSE OUTCOMES

At the end of this course, the students will be able to

- cultivate the values needed for peaceful living in the existing society.
- comprehend humanistic values to develop peace in the world.
- foster ethics in profession and usage of Technology.
- orient with the importance of value education towards personal, group and spiritual attributes.
- nurture physical, mental, spiritual growth to face the competitive world.

TEXT BOOKS

1. Little William, An Introduction of Ethics. Allied Publisher, Indian Reprint 1955.
2. Sharma S.P. Moral and value education; Principles and practices, Kanishka publishers, 2013.

REFERENCES

1. "Values (Collection of Essays)". Sri Ramakrishna Math. Chennai. 1996.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak														
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CO2	-	-	-	2	-	2	-	1	3	2	1	3	-	2
CO3	-	-	3	2	2	3	2	3	3	1	3	3	2	3
CO4	-	-	3	1	-	2	-	-	1	-	-	3	2	-
CO5	-	-	-	-	-	1	-	-	-	-	-	3	-	-



COURSE OBJECTIVES

To enable the students to

- compute Coefficient of discharge of given Orifice meter.
- calculate the rate of flow using Rota meter and friction factor for a given set of pipes.
- find out efficiency of reciprocating and gear pump.
- select a suitable type of turbine for the given situation

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submersible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

TOTAL PERIODS : 30

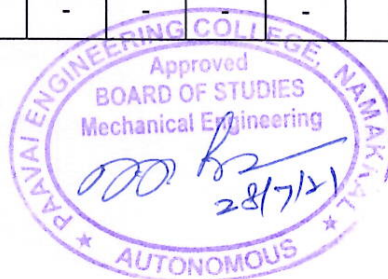
COURSE OUTCOMES

At the end of this course, students will be able to

- determine the coefficient of discharge of given orifice meter.
- analyse the rate of flow using rota meter and friction factor for a given set of pipes
- choose an appropriate pump for a specific application.
- test the performance of turbines.

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CO3	3	2	3	2	-	-	-	-	-	-	-	2	2	2
CO4	3	3	3	2	-	-	-	-	-	-	-	2	2	2



EE20314

ELECTRICAL TECHNOLOGY LABORATORY

0 0 2 1

COURSE OBJECTIVES

To enable the students to

- study the concept of basic theorems.
- acquire knowledge on electric power measurement.
- know the performance and characteristics of transformer and motor.
- study the different types of protective devices.

LIST OF EXPERIMENTS

1. Verification of Kirchhoff's laws
2. Verification of Superposition theorem
3. Measurement of power in an AC circuit by three ammeters and three voltmeter method.
4. Load test on a DC series motor.
5. Speed characteristics of DC shunt motor.
6. Regulation of a transformer.
7. Load characteristics of a three phase induction motor.
8. Study of protective relays and circuit breakers.

TOTAL PERIODS: 30**COURSE OUTCOMES**

At the end of this course, students will be able to

- analyse the different types of theorem.
- measure the electrical parameters using three ammeters and three voltmeter method.
- test the characteristics of transformer and motor.
- understand the concept of basic relaying and circuit breakers.

CO-PO MAPPING

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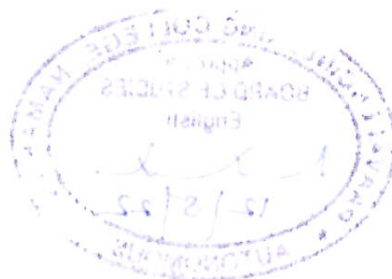
COURSE OBJECTIVES

To enable the students to

- familiarize with the reading skills such as skimming and scanning.
- practise writing tasks to the level expected.
- develop listening strategies such as listening for key words, making inferences and identifying main ideas.
- speak well without inhibition and to assist the students in improving their vocabulary, pronunciation and comprehension of grammar.
- enrich their LSRW skills so as to crack on-line proficiency tests and to bring their career aspirations true.

EXERCISES FOR PRACTICE

1. Listening Exercises from TOEFL
 - a. Conversations, Lectures
2. Listening Exercises from IELTS
 - a. Places and directions
 - b. Actions and processes
3. Reading Exercises from PTE
 - a. Re-order paragraphs
4. Reading Exercises from IELTS
 - a. Opinions and attitudes
 - b. Locating and matching information
5. Reading Exercises from BEC Vantage
 - a. Single informational text with lexical gaps
 - b. Error identification
6. Writing Exercises from PTE
 - a. Summarize written text
7. Writing Exercises from IELTS
 - a. Describing maps
 - b. Describing diagrams



8. Speaking IELTS format

- a. Talking about familiar topics
- b. Giving a talk
- c. Discussion on aTopic

TOTAL PERIODS : 30

COURSE OUTCOMES

At the end of this course, the students will be able to

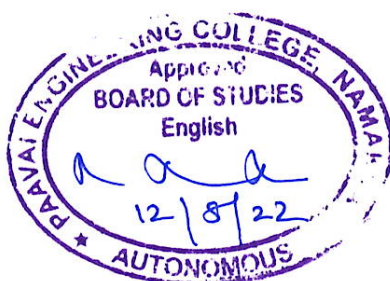
- skim, scan and infer the given texts and attend the tasks successfully.
- write coherently using appropriate vocabulary and grammar.
- listen to speeches and conversations and answer the questions.
- communicate fluently and effectively on any given topics.
- appear with confidence for on-line tests.

REFERENCES

1. Cambridge University Press India Pvt. Ltd, New Delhi.2016.
2. PTE Academic Test builder. Macmillan Education. London. 2012.
3. Cambridge IELTS 12 Academic Student's Book with Answers: Authentic Examination Papers (IELTS... by Cambridge University Press . New Delhi.2016
4. TOEFL iBT Prep Plus 2018-2019 4 Practice Tests) Kaplan Publishing. Newyork.2017.

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CO3	-	-	-	-	-	3	1	2	3	2	2	3	2	-
CO4	-	-	-	-	-	2	2	3	3	2	2	-	2	-
CO5	-	-	2	-	-	1	2	-	3	3	-	1	2	3



அலகு I நெசவு மற்றும் பானைத் தொழில்நுட்பம் 3
சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு II வடுவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் 3
சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை வடிவமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும் கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டி நாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக்கலை

அலகு III உற்பத்தி தொழில் நுட்பம் 3
கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பு உருக்குதல், எஃகு - வரலாற்றுச் சின்னங்களாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத் துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு IV வேளாண்மை மற்றும் நீர்பாசனத் தொழில்நுட்பம் 3
அணை - ஏரிகுளங்கள், மதகு - சோழர்காலக் குமிழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்

அலகு V அறிவியல் தமிழ் மற்றும் கணித்தமிழ் 3
அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் சொற்குவைத் திட்டம்

TEXT CUM REFERENCE BOOKS:

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே.பிள்ளை. (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு).
4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A Joint publication of TNTB & ESC and RMRL – (in print).
6. Social Life of the Tamils – The Classical Period (Dr.S.Singaravelu) (Published by International institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subramanian, Dr.K.D.Thirunavukkarasu)
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by International institute of Tamil Studies)
9. Keeladi – ‘Sangam City Civilization on the banks of river vaigai’ (Jointly Published by Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by the author)
11. Porunai Civilization (Jointly Published by Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamilnadu).
12. Journey of Civilization Indus to vaigai (R.Balakrishnan) (Published by RMRL) – Reference Book



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TAMILS AND TECHNOLOGY

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UNIT I WEAVING AND CERAMIC TECHNOLOGY

3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY

3

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY

3

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel - Copper and gold Coins as source of history - Minting of Coins – Beads making - industries Stone beads - Glass beads - Terracotta beads - Shell beads/ bone beads - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY

3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoombu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING

3

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project

TOTAL PERIODS: 15

TEXT CUM REFERENCE BOOKS:

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே.பிள்ளை. (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
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3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு).
4. பொருதை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு).

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10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by the author)
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12. Journey of Civilization Indus to vaigai (R.Balakrishnan) (Published by RMRL) – Reference Book



(Common to Robotics, Safety & Fire Engineering)**OBJECTIVES****To enable the students to**

- this course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- to acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems
- to introduce the basic concepts of solving algebraic and transcendental equations.
- to introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration this plays an important role in engineering and technology disciplines.
- to acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I TESTING OF HYPOTHESIS 12

Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS 12

One way and two way classifications - Completely randomized design – Randomized block design – Latin square design – 2^2 factorial design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12

Solution of algebraic and transcendental equations - Newton Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods - Secant method and Gauss Seidel method- Eigenvalues of a matrix by Power method.

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 12

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical Single Integration-Trapezoidal rule, Simpson's 1/3 rule and 3/8 rule.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 12

Single step methods: Taylor's series method –Runge-Kutta method for solving first order differential equations - Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order differential equations

TOTAL PERIODS: 60

OUTCOMES

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

- apply the concept of testing of hypothesis for small and large samples in real life problems
- apply the basic concepts of classifications of design of experiments in the field of agriculture
- appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems
- understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications

TEXT BOOKS

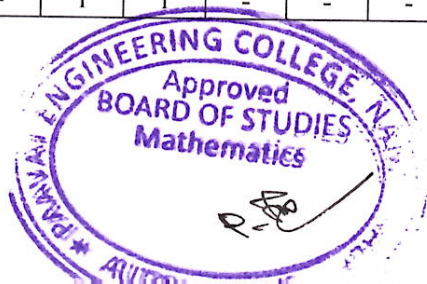
1. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.
2. Sankar Rao K " Numerical Methods for Scientists And Engineers –3rd Edition Princtice Hall of India Private, New Delhi, 2007.

REFERENCE BOOKS

1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7th Edition, 2007.
3. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics", Tata McGraw Hill Edition, 4th Edition, 2012.
4. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015

CO/PO Mapping

Mapping of Course Outcomes with Programme Outcomes (3/2/1 indicates strength of correlation) 3- Strong, 2-Medium, 1-Weak														
COs	Programmes Outcomes(POs)												PS O1	PS O2
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		
CO1	3	3	-	1	1	-	-	-	-	-	-	3	-	-
CO2	3	3	-	1	1	-	-	-	-	-	-	3	-	-
CO3	3	3	-	1	1	-	-	-	-	-	-	3	-	-
CO4	3	3	-	1	1	-	-	-	-	-	-	3	-	-
CO5	3	3	-	1	1	-	-	-	-	-	-	3	-	-



COURSE OBJECTIVES

To enable the students to

- anticipate, recognize, evaluate and control hazardous conditions and practices affecting people.
- communicate and interact effectively with technical and non-technical audiences.
- integrate ethical, social, current, global issues and responsibilities in their practice.
- work individually or on a team to critically analyze, interpret to address and manage problems in occupational safety and health.
- recognize that the practice of occupational safety and health requires ongoing learning, and undertake appropriate activities to address this need.

UNIT I OCCUPATIONAL HAZARD AND CONTROL PRINCIPLES 9

Concept and spectrum of health- functional units and activities of occupational health services - Levels of prevention of diseases - notifiable occupational diseases, their effects and prevention - Industrial toxicology - local and systemic effects - TLVs - carcinogens, mutagens, teratogens. Instruments for Radiation detection and measurement. Early recognition of radiation hazard. Personal monitoring devices, Medical support. Hazards associated with Laser, infra-red, ultra violet and ELF.

UNIT II PHYSICAL HAZARD MEASUREMENT, EVALUATION AND CONTROL 9

Recognition, evaluation and control of physical hazards. Vibration - measurement and control methods. Noise - measurement, control methods -hearing loss - causes - Biological effects. Thermal stress - heat disorders and health effects. WBGT index, acclimatization. Ventilation systems – principles, requirements, comfort level. Natural ventilation – types - Ventilation measuring instruments - Standards on ventilation. Purpose of lighting. Sources and kinds of artificial lighting principles of good illumination. Lighting and color.

UNIT III PRINCIPLES OF FIRST AID 9

First Aid principles-Role of the first aider. Vital signs - breathing -pulse. Introduction to the body-basic anatomical terms-body cavities-head- cranium - thorax- abdomen and pelvis. Biomechanics - Structure and functions of musculoskeletal systems, tendons, ligaments, fascia, bone, muscles, joints and basic mechanisms. Fainting-recognition management-aftercare. Diabetes - hypoglycemia – hyper glycaemia- management. Seizures features-management, stroke. Head injuries-fractures of the basevault and sides of skull.

UNIT IV FIRST-AID PRACTICE IN INDUSTRY 9

The circulatory system-heat attack-chest compression- CPR. Shock -causes - signs and symptoms - management of shock. Eye-eye injuries-foreign body in eye-eye trauma-corrosive chemical in eye arc eye. Wounds-bleeding-classification-types of wounds-case of wounds- bleeding from special sites. Fractures- classification of fractures-principles of immobilization- sprains and dislocation. Broad and narrow fold bandages-hand bandages-slings. The skin Poisoning. Physical fitness. Lifting -casualty handling. Use of stretchers.

UNIT V OCCUPATIONAL AND PSYCHOLOGICAL HAZARDS

9

Elements of Industrial Psychology-Mental Health in Industries- Organizational Behavior, Motivational Theory, Job Satisfaction Value system, Habits, Drug Abuse-Alcoholism in Industry, Communications, and Psychological Hazards - Workplace Stress- General Adaptation Syndrome Eustress –Distress Diseases - Psychosomatic disorders. Managing Work-stress in industry- Individual responsibilities - Employers Responsibilities. Psychological Counseling of employees- Employees Assistance Programme, Behavior based Safety.

TOTAL PERIODS : 45

COURSE OUTCOMES

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

- identify, formulate, and solve broadly defined technical by applying knowledge of mathematics and science and/or technical topics to areas relevant to occupational safety and health.
- develop and conduct experiments or test hypotheses, analyze and interpret data and use scientific judgment to draw conclusions.
- communicate effectively with a range of audiences.
- understand ethical and professional responsibilities and the impact of technical and/or scientific solutions in global, economic, environmental, and societal contexts.
- function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk.

TEXT BOOKS

1. Goetsch D.L., (1999), Occupational Safety and Health for Technologists, Engineers and Managers, Prentice Hall.
2. Slote. L, Handbook of Occupational Safety and Health, John Willey and Sons, New York

REFERENCES

1. Fundamentals of Industrial Hygiene. 5th Ed. Plog, Barbara and Patricia Quinlain. Chicago, IL: National Safety Council, 2001
2. The industrial environmen-its evaluation and control. DHHS (NIOSH) publication number 74- 117, 1973.
3. Clayton,C.D. and Clayton, "Industrial hygiene and toxicology".Wiley Inderscience, NewYork.1981
4. The Occupational Environment Its Evaluation and Control. 2nd Edition. Dinardi, Salvatore. Fairfax, VA: American Industrial Hygiene Association, 2003.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak														
COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	-	-	2	-	1	2	1	-	-	-	-	1	-	-
CO2	-	-	2	3	1	2	1	-	-	-	-	-	-	-
CO3	-	-	2	-	1	2	1	-	-	-	-	-	-	-
CO4	-	-	2	-	1	2	1	2	-	-	-	-	-	1
CO5	-	-	2	3	1	2	1	2	-	-	-	1	-	2



COURSE OBJECTIVES

To enable the students to

- familiarize the terminology like simple stresses, strains and deformation in components due to external loads.
- comprehend the stresses and deformations through mathematical models of beams, twisting bars or combinations of both.
- analyze torsion of circular bars and stresses in helical springs.
- understand about the deflection and slope of the beams under various loading conditions.
- determine the stresses in thin cylindrical and spherical shells.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

Rigid and Deformable bodies – Strength, Stiffness and Stability; Stresses - Tensile, Compressive and Shear; Deformation of simple and compound bars under axial load; Thermal stress; Shear stress and strain, Lateral strain and Poisson's ratio – Relationship between Elastic constants – Volumetric strains; Stresses on inclined plane – Principal planes and stresses – Mohr's circle of stresses.

UNIT II BEAMS, LOADS AND STRESSES 9

Types of beams - Supports and Loads; Shear force and Bending Moment diagram in beams – Cantilever, simply supported and over hanging beams subjected to concentrated loads, uniformly distributed and uniformly varying loads; Theory of Simple Bending, Section Modulus; Bending stress distribution; Flitched beams.

UNIT III TORSION OF SHAFTS AND SPRINGS 9

Analysis of torsion of circular bars – Bars of Solid and hollow circular section; Power transmitted by a Shaft - Stepped shaft – Torsion stiffness – Compound Shafts – Deflection of shafts fixed at both ends; Stresses in helical springs – Deflection of helical coil springs under axial loads.

UNIT IV DEFLECTION OF BEAMS 9

Evaluation of beam deflection and slope - Double Integration Method, Macaulay Method and Moment-Area Method for computation of slopes and deflections in beams; Concept of Conjugate beam method (Theory only); Maxwell's reciprocal theorems.

UNIT V THIN SHELLS 9

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders; spherical shells subjected to internal pressure – Deformation in spherical shells; Lamé's theorem.

TOTAL PERIODS : 45

COURSE OUTCOMES

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

- apply the concepts of strength of materials to obtain solutions to real time Engineering problems.

- analyze the deformation behavior of simple structures subjected to different loads.
- estimate torsion of circular bars and stresses in helical springs.
- interpret the deflection and slope of beams using different methods under various loading conditions.
- compute the stresses in thin cylindrical and spherical shells.

TEXT BOOKS

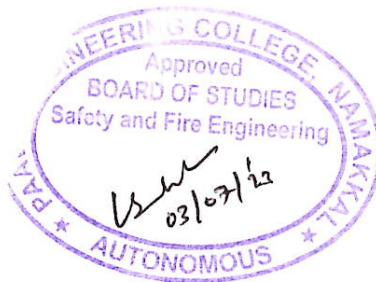
1. Bansal R.K, "Strength of Materials", Laxmi Publications Ltd., Fifth Edition, 2012.
2. Beer F. P. and Johnston R, "Mechanics of Materials", McGraw-Hill Book Co, Sixth Edition, 2011.

REFERENCES

1. Popov E.P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, 2015.
2. Rajput R. K, "Strength of Materials: Mechanics of Solids", S. Chand Limited, 2018.
3. Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 2006.
4. Ryder G.H, "Strength of Materials, Macmillan India Ltd". Third Edition, 2002.

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CO1	3	3	3	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	3	-	-	-	-	-	-	-	-	3	3	2
CO3	3	3	3	-	-	-	-	-	-	-	-	2	3	2
CO4	3	2	3	-	-	-	-	-	-	-	-	2	3	2
CO5	3	2	2	-	-	-	-	-	-	-	-	2	3	2



COURSE OBJECTIVES

To enable the students to

- anticipate, identify and evaluate hazardous conditions and practices.
- develop hazard control designs, methods, procedures, and programs.
- illustrate the basic concepts and techniques of modern reliability engineering tools.
- provide the students an illustration of significance of the Fire Engineering profession in the protection life.
- understand the importance of life safety in building fire and method of evacuation.

UNIT I PROPERTIES OF COMBUSTION 9

Introduction- temperature, heat, specific heat, flash & fire point, ignition, combustion; Ignition- pilot, spontaneous ignition, Types of combustion. Development of fire- incipient, smoldering, flame and heat stages; Diffusion flames-zones of combustion, smoldering combustion,; Premixed flames-burning velocity, limits of flammability, explosion and expansion ratios, deflagration and detonation, characteristics of premixed flame; Explosion- physical explosion, chemical explosion; Special kinds of combustion- Flash fire, Pool fire, Deep seated fire, Spillover, Boil over, Dust explosion, BLEVE, UVCE; Classification of fire based on material.

UNIT II BEHAVIOUR OF BUILDING ELEMENTS UNDER ACTION OF FIRE 9

Product of combustion-flame, heat, smoke, fire gases; spread of fire in rooms and buildings; Effect of heat exposure to human body, Smoke - constituents quantity and quality of smoke, smoke density, visibility, smoke movement in buildings and modeling; Smoke control in buildings natural and mechanical ventilation, pressurization; Design principles of smoke control using pressurization technique; Principles of smoke vent design. Toxicity of smoke-effect of harmful agents preventing escape and causing injury or death - CO, CO₂, HCN, SO₂, NH₃, Nitrogen oxide.

UNIT III OPERATION HANDLING AND MAINTENANCE OF FIRE SERVICE EQUIPMENTS AND ACCESSORIES 9

Introduction to fire fighting vehicles - Pumps, primers, crash tenders, rescue tenders, hose laying tenders, control vans, hydraulic platforms - Delivery Hose, Hose reel, Hose fittings- coupling, adapters, branches, branch holders, radial branches, collecting heads, stand pipe, monitors, hydrants;; Ladders- Uses and maintenance of small gear and miscellaneous equipment's used during firefighting; Lamps and lighting sets; Ropes and Lines- Types-wire and rope lines used in fire service. Use and testing of lines, knots, Bends and hitches; General rope work.

UNIT IV HYDRAULIC SYSTEM 9

Fire stream-path, range; nozzles-types, calculation of discharge capacity, nozzle reaction; friction losses in pipes, fire hoses and fixtures, parallel and series connections; Flow in pipes and fire hoses, branching lines; water relay techniques; Estimation of fire protection water requirements, pump capacity and other parameters relating to fire hydraulics. Fire ground operations - preplanning, action on arrival and control, methods of rescue, methods of entry. Personnel safety. Control procedure and use of other safety equipment. Ventilation and salvage operations.

UNIT V FIRE SUPPRESSION & PROTECTION

9

Introduction, Definitions, Water as an extinguishing agent, Basic Components of a Fire Protection system, Classification of fire protection systems-Active & Passive: Active FPS Definitions, classifications- Water Based (Vs) Non water based & Fixed (Vs) Portable/Mobile, Types:- Fire Extinguishers, Fire hydrants, Sprinklers, standpipe systems, Fire detectors, water spray systems - definitions, types, operation, applications & limitations, selection, installation & maintenance as per relevant national and international standards(IS, OISD, NFPA etc).

TOTAL PERIODS : 45

COURSE OUTCOMES

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

- explain the basics of fire engineering.
- classify the types of combustion and its products.
- demonstrate the operation of fire service equipment's and practical firefighting.
- categorize the buildings and design the evacuation methods
- apply acquired knowledge on real life problem.

TEXT BOOKS

1. Gupta, R.S., "Hand Book of Fire Technology" Orient Longman, Bombay 1977.
2. Barendra Mohan Sen, "Fire protection and prevention the essential handbook". UBS Publishers' Distributors Pvt. Ltd, 2009.

REFERENCES

1. Ron Hirst, "Underdowns Practical Fire Precautions", Gower Publishing Company Ltd., England, 1989.
2. Jain V.K. "Fire safety in buildings" (2nd edn.). New Age International (P) Ltd., New Delhi.2010.
3. Barendra Mohan Sen,"Fire protection and prevention the essential handbook", UBS publishers and Dist., New Delhi,2013.
4. Jain V.K., "Fire Safety in Buildings", New Age International (P) Ltd., New Delhi, 1996

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CO2	-	-	3	1	2	2	-	-	-	-	-	-	2	2
CO3	-	-	1	1	1	2	1	-	-	-	-	-	-	-
CO4	-	-	2	1	1	2	1	-	-	-	-	-	-	-
CO5	-	-	1	1	2	2	2	1	-	-	-	1	2	2



COURSE OBJECTIVES

To enable the students to

- know causes of accidents related to construction activities and human factors associated with these accident.
- understand the construction regulations and quality assurance in construction
- have the knowledge in hazards of construction and their prevention methods
- know the working principles of various construction machinery
- gain knowledge in health hazards and safety in demolition work course

UNIT I INTRODUCTION

9

Introduction to construction industry and safety issues in construction-Human factors in construction safety management- Roles of various groups and stake-holders in ensuring safety in construction industry -Framing of contract conditions on safety and related matters –Relevance of ergonomics in construction safety.

UNIT II SAFETY IN CONSTRUCTION OPERATIONS

9

Safety in various construction operations - Excavation and filling - Under- water works - Under-pinning & Shoring - Ladders & Scaffolds - Tunneling - Blasting - Dismantling - Confined space-Temporary Structures. Noise standards and limit values; noise instrumentation and monitoring procedure. Noise indices. Effects of air pollution in Industry, air pollution episodes; Emission factors inventory and predictive equations. Familiarization with relevant Indian Standards and the National Building Code provisions on construction safety.

UNIT III CONSTRUCTION MACHINERY

9

Safety in material handling and equipment's-Safety in storage & stacking of construction materials. Safety in the use of construction equipment/vehicles - excavators, graders and dozers - cranes - hoists & lifts - other lifting gears~ wire ropes - chain-pulley blocks - mixers -conveyors- pneumatic and hydraulic tools in construction. Safety in temporary power supply and fire safety at construction site.

UNIT IV CONSTRUCTION ACT AND CODE OF PRACTICES

9

Contract Labour (R&A) Act and Central Rules: Definitions, Registration of Establishments, Licensing of Contractors, Welfare and Health provisions in the Act and the Rules, Penalties, Rules regarding wages. Building& Other Construction Work (RE & CS) Act, 1996 and Central Rules, 1998: Applicability, Administration, Registration, Welfare board & Welfare Fund, Training of Building workers, General Safety, Health & Welfare provisions. Code of Practices - -Preventive measures against Hazards at work places Part1&2.

UNIT V SAFETY IN DEMOLITION WORK

9

Safety in demolition work, manual, mechanical, using explosive - keys to safe demolition, pre survey inspection, method statement ,site supervision ,safe clearance zone, health hazards from demolition - Indian standard -

trusses, girders and beams – first aid – fire hazards and preventing methods–Case studies in construction sites against the fire accidents.

TOTAL PERIODS : 45

COURSE OUTCOMES

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

- visualize the safety issues at different stages of construction activity.
- understand the safety requirements in various construction operations and develop guidelines to ensure safety at construction site.
- understand the safety requirements in material handling and equipment’s and develop guidelines to ensure safety at construction site.
- learn the legal provisions with respect to the health and welfare of workers at construction site.
- list out construction regulations and indian standards for construction and demolition work.

TEXT BOOKS

1. Hudson.R.”Construction hazard and Safety Handbook, Butter Worth’s, 1985.
2. Raymond Elliot Levitt, Nancy Morse Samelson, “Construction Safety Management, McGraw-Hill, London, 1987.

REFERENCES

1. Jnathea D.Sime, “Safety in the Build Environment”,London,1988.
2. Davies,V. J., and Tomasin,K.(1996).Construction safety hand book. Thomas Telford Publishing, London.
3. Ratay,R.T.(1996).Handbook of temporary structures in construction(2ndEdition.).McGraw-Hill, London.
4. Fulman,J.B., Construction Safety, Security & Loss Prevention, John WileyandSons,1979

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak														
COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	2	-	-	-	2	1	-	-	-	2	1	-	2
CO3	2	2	2	-	-	3	1	-	-	-	-	-	2	-
CO4	-	-	-	-	-	-	-	3	-	-	2	-	-	-
CO5	1	2	2	-	-	2	1	-	-	-	1	1	-	2



COURSE OBJECTIVES

To enable the students to

- gain knowledge on different concepts and terminology used in metrology and errors of precision instruments.
- know about linear and angular measurement techniques that are used with various precision measuring instruments.
- understand measurement of parameters of screw thread, gear tooth and different form measurements like straightness, flatness and roundness measurements of machine components.
- learn about techniques and instruments used to measure power, flow and temperature.
- acquire knowledge on the advancements in measurements like usage of laser, CMM, Machine vision, Data Acquisition system and Nano metrology.

UNIT I INTRODUCTION TO METROLOGY 9

Definition of metrology – Generalized measurement system. Geometric and Dimensioning – symbols, introduction to tolerance analysis - Units and standards - measuring instruments: sensitivity, stability, range, accuracy, precision and uncertainty - static and dynamic response-repeatability-systematic and random errors-correction, calibration-limits, fits and tolerances (simple problems)-Introduction to Dimensional and Geometric Tolerancing-interchange ability- types of standards.

UNIT II LINEAR AND ANGULAR MEASUREMENT 9

Linear measuring instruments: Vernier, micrometer, Slip gauges –Tool Makers Microscope, Profile projector-Comparators: Mechanical, pneumatic and electrical comparators, limit gauges. Angular measurements: Sine bar, Sine center, Bevel protractor, Angle Decker and Autocollimator- applications.

UNIT III FORM MEASUREMENT 9

Measurement of screw threads: Thread gauges, floating carriage micrometer measurement of gear tooth thickness: constant chord and base tangent method-Gleason gear testing machine– surface finish measurement: terminology, instruments - straightness, flatness and roundness measurements.

UNIT IV MEASUREMENT OF POWER, FLOW AND TEMPERATURE 9

Power: mechanical, pneumatic, hydraulic and electrical type – Flow measurement: Venturi, orifice, rotameter, pitot tube –Temperature measurement: bimetallic strip, thermocouples, pyrometer, electrical resistance thermistor.

UNIT V LASER AND ADVANCES IN METROLOGY 9

Precision instruments based on laser: Principles, laser interferometer, application in measurements- machine tool metrology-Coordinate measuring machine (CMM):need, construction, types, applications – Machine Vision system – Introduction to Data acquisition system and Nano metrology. 3D scanning for reverse Engineering.

TOTAL PERIODS : 45

COURSE OUTCOMES

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

- discuss with knowledge about the general concepts, units, standards, errors, calibration and other terms involved in the process of measurements
- apply the understanding of the working principle of instruments like vernier, micrometer and slip gauges to handle them.
- discuss knowledgeably about the measuring techniques of various parameters of screw threads, gears, surface finish and other geometrical forms.
- have an in-depth knowledge of using appropriate instruments and techniques for the measurements of power, flow, and temperature
- illustrate in-depth understanding about the recent trends in metrology like laser measurements, coordinate measuring machine, machine vision, nano-metrology and Data Acquisition System.

TEXT BOOKS

1. Jain.R.K., “Engineering Metrology”, Khanna Publishers, 2005.
2. Gupta.S.C, “Engineering Metrology”, Dhanpat Rai Publications, 2006.

REFERENCES

1. Alan.S.Morris, “The Essence of Measurement”, Prentice Hall of India, 1997.
2. Jayal.A.K, “Instrumentation and Mechanical Measurements”, Galgotia Publications 2000.
3. Beckwith, Marangoni, Lienhard, “Mechanical Measurements”, Pearson Education, 2006.
4. Holman.J.P, “Experimental Methods for Engineers” McGraw-Hill Companies, Inc, 2012.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	1	-	-	-	-	-	-	2	3	2
CO2	3	1	-	-	1	-	-	-	-	-	-	2	3	2
CO3	3	-	-	-	1	-	-	-	-	-	-	2	3	2
CO4	3	-	-	-	1	-	-	-	-	-	-	2	3	2
CO5	3	-	-	-	1	-	-	-	-	-	-	2	3	2



SF20406

INDUSTRIAL HYGIENE LABORATORY

0 0 2 1

COURSE OBJECTIVES

To enable the students to

- estimate the different pollutants in the atmosphere using air sampling equipment
- evaluate heat stress in industries.
- measure different physical hazards such as noise, illumination etc.,
- experiment the lung function and measurement of thermal stress.

LIST OF EXPERIMENTS

1. Study of Personal Protective equipment
2. Study of occupational diseases with photographic models.
3. Demonstration of Air sampling equipment.
4. Sampling and estimation of dusts using high volume sampler
5. Sampling and estimation of dust using personal sampler
6. Measurement of Noise
7. Measurement of illumination
8. Vision testing
9. Lung functions testing.
10. Measurement of thermal stress

TOTAL PERIODS : 30

COURSE OUTCOMES

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

- learn the personal protective equipment
- study of occupational diseases with photographic
- measure the noise and illumination
- carryout the measurement of thermal stress

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak														
COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	-	3	2	-	2	-	-	-	-	1	1	2	1
CO2	2	-	3	2	-	2	-	-	-	-	2	2	2	2
CO3	1	-	3	2	-	2	-	-	-	-	1	2	2	1
CO4	1	-	3	2	-	2	-	-	-	-	2	1	2	2



COURSE OBJECTIVES

To enable the students to

- understand the precision measurement and calibration processes of instruments
- familiarize with different measuring equipment and their usage in industries for measurement and inspection
- practice measurement of different parameters like length, angle, torque, pressure and temperature.
- carry out form measurements on gear teeth and screw thread and also straightness of surface

LIST OF EXPERIMENTS

1. Calibration of precision instrument: Vernier Caliper/Micrometer/DialGauge
2. Measurements of Gear Tooth Dimensions using optical profile projector
3. Measurement of Angle using sinebar / sinecenter/ bevel protractor
4. Measurement of straightness using Autocollimator
5. Measurement of thread parameters using Floating Carriage Micrometer
6. Checking limits of dimensional tolerance using comparators(Mechanical/Pneumatic)
7. Measurement of Temperature using Thermocouple
8. Calibration of Linear Variable Differential Transformer (LVDT) using displacement measuring setup
9. Measurement of Force using strain gauge
10. Measurement of Torque using strain gauge
11. Measurement of Vibration
12. Finding resolution of Electrical comparator
13. Measuring screw thread dimensions using Tool Makers Microscope
14. Measurement of Gear Tooth Thickness using Gear Tooth Vernier

TOTAL PERIODS: 30

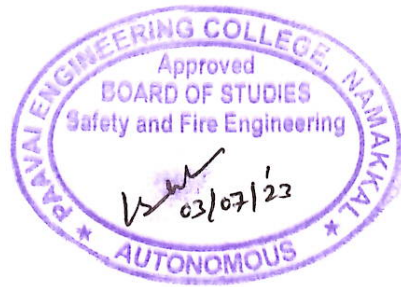
COURSE OUTCOMES

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

- handle different precision measurement tools with appropriate measuring techniques and also carry out calibration processes
- study and analyze the characteristics of precision instruments
- use contact and non-contact measuring instruments, limit gauges and comparators for measurements, checking and inspection
- demonstrate practical knowledge on geometrical parameters like straightness, flatness, roundness, parallelism.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	1	1	-	2	2	3
CO2	3	2	-	-	-	-	-	-	1	1	-	2	2	3
CO3	3	2	-	-	-	-	-	-	1	1	-	2	2	3
CO4	3	2	-	-	-	-	-	-	1	1	-	2	2	3



COURSE OBJECTIVES

To enable the students to

- conduct tension test on different metals.
- interpret compression tests on spring and concrete.
- carry out flexural and torsion tests to determine elastic constants.
- determine hardness of metals.

LIST OF EXPERIMENTS

1. Tension test on mild steel rod
2. Compression test on wood
3. Double shear test on metal
4. Torsion test on mild steel rod
5. Impact test on metal specimen (Izod and Charpy)
6. Hardness test on metals (Rockwell and Brinell Hardness Tests)
7. Deflection test on metal beam
8. Compression test on helical spring
9. Deflection test on carriage spring
10. Test on Cement

TOTAL PERIODS : 30

COURSE OUTCOMES

At the end of this, course the student will be able to

- determine stresses and strains from the member forces
- find out deflection, bending and torsion on mild steel specimen
- calculate elastic constants for different materials.
- compute hardness of different metals

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak														
COs	Programme Outcomes(POs)												PSO1	PSO2
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12		
CO1	3	3	2	2	-	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	-	-	-	-	-	-	-	2	2	2
CO3	3	2	3	2	-	-	-	-	-	-	-	2	2	2
CO4	3	3	3	2	-	-	-	-	-	-	-	2	2	2

