St. Johns College of Engineering & Technology (Autonomous)

(Accredited by NAAC, Approved by AICTE, Recognized by UGC under 2(f) & 12(B) An ISO 9001:2015 Certified Institution and Affiliated to JNTUA, Ananthapuramu)

Yerrakota, Yemmiganur-518360, Kurnool (Dist), Andhra Pradesh, India.

M.Tech (Regular-Full time)

(Effective for the students admitted into I-Year from the Academic Year **2024-25** onwards)

Refrigeration & Air Conditioning

I & II YEAR COURSE STRUCTURE AND SYLLABUS

St.Johns College of Engineering and Technology

(AUTONOMOUS)

M.TECH. IN REFRIGERATION & AIR-CONDITIONING

M.TECH. IN REFRIGERATION & AIR-CONDITIONING
COURSE STRUCTURE & SYLLABI-R24

I Semester

S.No.	Course code	Title	L	T	P	Credits
1	24G3D17101	Advanced Refrigeration	3	0	0	3
2	24G3D17102	Advanced Thermodynamics	3	0	0	3
3	24G3D17103a 24G3D17103b 24G3D17103c	**Program Elective Course - I** Conduction and Radiation Heat Transfer Design Optimization Food Preservation Techniques	3	0	0	3
4	24G3D17104a 24G3D17104b 24G3D17104c	**Program Elective Course–II** Principles of Air Conditioning Cryogenic Engineering Solar Refrigeration and Air Conditioning	3	0	0	3
5	24G3D17105	Refrigeration Laboratory	0	0	4	2
6	24G3D17106	Heat Transfer Laboratory	0	0	4	2
7	24G3DRM101	Research Methodology and IPR	2	0	0	2
8	24G3DAC101a 24G3DAC101b 24G3DAC101c	**Audit Course–I** English for Research paper writing Disaster Management Sanskrit for Technical Knowledge	2	0	0	0
Total			**14**	**0**	**8**	**18**

St.Johns College of Engineering and Technology

(AUTONOMOUS)

M.TECH. IN REFRIGERATION & AIR-CONDITIONING

II Semester

S.No.	Course code	Title	L	T	P	Credits
1	24G3D1 7201	Design of Air-Conditioning Systems	3	0	0	3
2	24G3D1 7202	Convective Heat and Mass Transfer	3	0	0	3
3	24G3D17203a 24G3D17203b 24G3D17203c	**Program Elective Course – III** Refrigeration Equipments & Control Design of Heat Transfer Equipment Advanced Thermal Storage Technologies	3	0	0	3
4	24G3D17204a 24G3D17204b 24G3D17204c	**Program Elective Course–IV** Advanced Fluid Mechanics Design of HVAC Systems Energy Conservation and Management	3	0	0	3
5	24G3D17205	Air-Conditioning Laboratory	0	0	4	2
6	24G3D17206	Advanced Fluid Mechanics Lab	0	0	4	2
7	24G3D17207	Technical seminar	0	0	4	2
8	24G3DAC201a 24G3DAC201b 24G3DAC201c	**Audit Course–II** Pedagogy Studies Stress Management for Yoga Personality Development through Life Enlightenment Skills	2	0	0	0
Total			**14**	**00**	**12**	**18**

St.Johns College of Engineering and Technology

(AUTONOMOUS)

M.TECH. IN REFRIGERATION & AIR-CONDITIONING

III Semester

S.NO	Subject Code	Title	L	T	P	Credits
1	24G3D17301a 24G3D17301b 24G3D17301c	**Program Elective Course – V** Design of Air Handling Systems Indoor Air Quality Control Cogeneration and Waste Heat Recovery	3	0	0	3
2	24G3DOE301c 24G3DOE301g 24G3DOE301h	**Open Elective** Business Analytics Internet of Things Mechatronics	3	0	0	3
3	24G3D17302	Dissertation Phase–I	0	0	20	10
4	24G3D17303	Co-curricular Activities				2
		Total	**06**	**0**	**20**	**18**

IV Semester

SNO	Subject Code	Title	L	T	P	Credits
1	24G3D17304	Dissertation Phase–II	0	0	32	16
		Total	**0**	**0**	**32**	**16**

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

ADVANCED REFRIGERATION

I M.Tech– I Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
24G3D17101	PC	3	0	0	3	40	60	100

Course Objectives:

- Understand the principles of refrigeration.
- Understand different vapor absorption systems.
- Know aircraft air refrigeration systems.
- Gain knowledge about refrigerants.
- Ozone depletion potential and global warming potential.

Course Outcomes After the completion of the course students will be able to

CO1:	Illustrate the basic concepts of refrigeration system.
CO2:	Analyze the vapour compression cycle and interpret the usage of refrigerants.
CO3:	Explain the components of vapour absorption system.
CO4:	Demonstrate the use of refrigerants.
CO5:	Discuss the theory of ozone depletion potential and global warming potential

UNIT-I: Vapor Compression Refrigeration
Analysis of vapor compression refrigeration cycle - reversed Carnot cycle for vapour - effect of suction temperature and condensing temperature on cycle performance – Practical refrigeration cycle –sub-cooled liquid and superheated vapor refrigeration cycles their effect on performance.MultiPressure Systems-removal of flash gas-intercooling–compound compression (conversion)-multi Vapor systems-cascade systems-dual compression-system practices.
UNIT-II: Simple vapor Absorption systems
Simple vapor Absorption systems- actual vapor absorption cycle- representation of the cycle on H-C diagram- common refrigerant- (Absorbent)Adsorbent) systems. Practical single effect Water- Lithium Bromide Absorption system- double effect system- Electrolux refrigerator- newer mixtures for absorption systems.
UNIT-III: Aircraft Air refrigeration and Steam jet water vapor systems
Aircraft Air refrigeration–Functions–working conditions–types.Steam jet water vapor systems-thermoelectric refrigeration systems-vortex refrigeration system- pulse tube refrigeration**.**
UNIT-IV: Refrigerants
Refrigerants: Desirable properties-thermodynamic-chemical and transport properties-designation of refrigerants -in organic, halocarbon refrigerants-secondary refrigerants-Properties of mixtures of refrigerants
UNIT-V: Ozone depletion potential and global warming potential
Ozone depletion potential and global warming potential–effect of refrigerants-alternative Refrigerants-newer refrigerants.

Textbooks:

1. Refrigeration & Air Conditioning by F. Stoecker & Jerold. W. Jones-MGHIntrl., 2018.
2. Refrigeration & Air Conditioning by C.P.Arora, TMGH-2017.

Reference Books:

1. Refrigeration & Air Conditioning by Manohar Prasad.
2. Principles of Refrigeration by Roy.J.Dossat,2017.
3. Refrigeration by Gosney-Oxford University Press-2019.

Online Learning Resources:

https://nptel.ac.in/courses/112/105/112105129/

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

ADVANCED THERMODYNAMICS

I M.Tech – I Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
24G3D17102	PC	3	0	0	3	40	60	100

Course Objectives:

- Solve theoretical and applied thermodynamics problems that are directly applicable to situations faced in research and industry.
- Significantemphasisisplacedontheintegrationofrecentthermodynamics-related research in to the traditional resources in order to foster critic a analysis of current work as it relates to fundamental Principles.

Course Outcomes: At the end of the course, the students will be able to:	
CO1:	Describe and calculate thermodynamic properties of single-phase and multi-phase systems.
CO2:	Apply the laws of statistical and classical thermodynamics to chemically reactive systems, kinetics, and combustion.
CO3:	Relate course principles to solve problems regarding gas turbines, combustion, refrigeration, and solar energy.
CO4:	Communicate engineering knowledge of thermodynamics through written and verbal means.
CO5:	Communicate engineering knowledge of IC Engines.

UNIT-I: Availability Analysis and Thermo dynamic Property Relations
Reversible work -availability –irreversibility and second – law efficiency for a closed system and steady –state control volume. Availability analysis of simple cycles. Thermodynamic potentials. Maxwell relations. Generalized relations for changes in entropy –internal energy and enthalpy-generalized relations for Cp and CV Clausius Clayper on equation, Joule–Thomson coefficient.Bridge man tables for thermodynamic relations.
UNIT-II: Real Gas Behavior and Multi Component Systems
Different equations of state–fugacity–compressibility-principle of corresponding States –Use of generalized charts for enthalpy and entropy departure - fugacity coefficient, Lee – Kesler generalized three parameter tables. Fundamental property relations for systems of variable composition Partial molar properties. Real gas mixtures - Ideal solution of real gases and liquid - activity - equilibrium in multi phase systems - Gibbs phase rule for non – reactive components
UNIT-III: Chemical Thermodynamics and Equlibrium
Thermo chemistry-First law analysis of reacting systems-Adiabatic flame temperature–entropychangeof reacting systems-Second law analysis of reacting systems-Criterion for reaction equilibrium. Equilibrium constant for gaseous mixtures-evaluation of equilibrium composition.
UNIT-IV Analysis of Vapour Power & Vapour Compression Refrigeration Cycles
Analysis of vapour power & Vapour compression refrigeration cycles: Rankine cycle with superheat, reheat and refrigeration-Energy analysis, Super – critical and ultra-super-critical Rankine cycle. VapourcompressionrefrigerationSystems,Analysisofvapourrefrigerationsystems,Com monly used
UNIT-V: Analysis of Gas Power Cycles

ICEngines: Air standard Otto, Diesel and Dual cycle Gas turbines: Air standard Braytoncycle, Effect of reheat, intercooling and regeneration, Combined gas and vapour power cycles.

Textbooks:

1. Kenneth Wark Jt. m, Advanced Thermodynamics for Engineers,McGrew–HillInc.,2017.
2. Bejan ,A., Advanced Engineering Thermodynamics, JohnWiley and Cons,2018.
3. Holman,J.P.,Thermodynamics,FourthEdition,McGraw–HillInc.,2016.
4. Fundamentals of Engineering Thermodynamics by V.Babu

Reference Books:

1. Smith, J.M.andVanNess.,H.C.,Introduction to Chemical Engineering Thermo dynamics, Fourth Edition, McGraw– HillInc.,2017.
2. Sonntag,R.E.,andVanWylen,G,IntroductiontoThermodynamics,Classical and Statistical Thermodynamics, Third Edition, John Wiley and Sons, 2014.
3. Sears, F.W. and Salinger G.I., Thermodynamics, Kinetic Theory and Statistical Thermodynamics, Third Edition, Narosa Publishing House, New Delhi, 2013.
4. DeHotf, R.T., Thermodynamics in Materials Science, McGraw Hill Inc., 2017.Rao,Y.V.C. Postulational and Statistical Thermodynamics ,Allied Publisher Limited , New Delhi,2017

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

CONDUCTION AND RADIATION HEAT RANSFER

I M.Tech– I Semester								SJCET-R24
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
24G3D17103a	**PE-I**	3	0	0	3	40	60	100

Course Objectives:

- Understand three modes of heat transfer.
- Understand Conduction through spherical shells.
- Know Heating and cooling of bodies with negligible internal resistance.
- Gain knowledge about thermal radiation.
- Understand Radiation network for an absorbing and transmitting medium.

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

CO1:	Determine these resistances for conduction, radiation,and convection heat transfer, using the fundamental relationships and correlations
CO2:	Learn to solve problems using solvers (multimode systems and design parameter sweep)
CO3:	Compare the various resistances, along with thermal energy conversion and storage, in the thermal systems and identifying the dominant resistance
CO4:	Learn to design modern, innovative thermal systems for various applications

UNIT-I: CONDUCTION
Introduction of three modes of heat transfer, steady,unsteady state heat transfer process, governing equations and boundary conditions Two dimensional steady state conduction, semi-infinite and finite flat plate; temperature field in infinite and finite cylinders.
UNIT-II: Conduction through spherical shells
Conduction through spherical shells , numerical methods, relaxation method and finite difference methods - simple problems.
UNIT-III: Heating and cooling of bodies
Heating and cooling of bodies with negligible internal resistance, sudden changes in the surface temperature of infinite plates, cylinders and semi-infinite bodies-simple problems.
UNIT-IV: Radiation
Review of the thermal radiation-gas radiation, mean beam length exchange between gas volume and black enclosure, heat exchange between gas volume and gray enclosure, problems.
UNIT-V: Radiation network and Solar radiation
Radiation network for an absorbing and transmitting medium, radiation exchange with Specular surfaces, radiation exchange with transmissivity and reflecting absorbing medium. Formulation for numerical solution. Solar radiation: Radiation properties of environment, effect of radiation on temperature measurement, the radiation heat transfer coefficient, problems.

Textbooks:

1) Heat Transfer-Gibhart-Mc.GrawHill.
2) Conduction Heat Transfer-Schneder AdditionWieslthy
3) Conduction of Heat in Solids-Carslaw & Jaeger.
4) Heat transfer-J.P .Holman, International student edition
5) Fundamentals of heat and mass transfer-R.C.Sachdev New-Age International
6) Heat Transfer by R.K.Rajput Publishers

Reference Books:

1) Heat Transfer-Gibhart-Mc.GrawHill.
2) Conduction Heat Transfer-Schneder AdditionWieslthy
3) Conduction of Heat in Solids-Carslaw &Jaeger.
4) Heat transfer-J.P.Holman ,International student edition
5) Fundamentals of heat and mass transfer-R.C.Sachdev New Age International
6) .Heat Transfer by R.K.Rajput Publishers

OnlineLearningResources:

- https://nptel.ac.in/courses/112/105/112105271

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

DESIGN OPTIMIZATION

I M.Tech– I Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
24G3D17103b	PE-I	3	0	0	3	40	60	100

Course Objectives:

- Understand the various optimization techniques such as classified optimization, linear programming. One dimensional minimization methods, unconstrained optimization techniques, constrained optimization techniques and dynamic programming.
- Understand the necessary sufficient conditions for finding the solution of the problems in classical optimization
- Comprehend the numerical methods for finding approximate solution of complicated problems.
- Apply methods like North West corner rule, least count method etc. to solve the transportation problem

Course Out comes:A student after completion of the course will be able to

CO1:	Design of mechanical systems and interdisciplinary engineering applications and business solutions using suitable optimization technique.
CO2:	Apply numerical or iterative techniques in power systems for optimal power flow solutions. Optimize the parameters in control systems for desired steady state or transient response.
CO3:	Optimize the cost function in deciding economic factors of power systems
CO4:	Design of electrical systems optimally using suitable techniques like univariate method ,steepest descent method etc

UNIT-I: Single variable non linear unconstrained optimization
One dimensional Optimization methods:-Uni-modal function, elimination method, Fibonacci method, golden section method, interpolation methods- quadratic & cubic interpolation methods
UNIT II: Multivariable non-linear unconstrained optimization
Direct search method – Univariant Method – pattern search methods – Powell's – Hook–Jeeves, Rosen brock search methods – gradient methods, gradient of function, steepest decent method, Fletcher reeves method. Variable metric method.
UNIT-III: Geometric Programming and Dynamic Programming
Polynomials–arithmetic–geometric inequality–unconstrained G.P–constrained G.P DYNAMIC PROGRAMMING: Multistage decision process, principles of optimality, examples, conversion of final problem to an initial value problem, application of dynamic programming, production inventory. Allocation, scheduling replacement
UNIT-IV: Linear Programming
Linear programming – formulation – Sensivity analysis. Change in the constraints, cost coefficients, coefficients of the constraints, addition and deletion of variable , constraints .Simulation –Introduction – Types – Steps – application – inventory – queuing – thermal system.
UNIT-V: Integer Programming and Stochastic Programming
Integer Programming–introduction–formulation–Gomory cutting plane algorithm– Zero orone algorithm, branch and bound method. STOCHASTICPROGRAMMING:

Basic concepts of probability theory, and om variables–distributions–mean, variance Correlation, co variance, joint probability distribution – stochastic linear, dynamic programming.

Textbooks:

1. Optimization theory & Applications/S.SRao/NewAge International
2. Introductory to operation research/Kasan & Kumar/Springar
3. Optimization Techniques theory and practice/M.C Joshi, K.M Moudgalya/N arosa Publications..
4. S.DSharma/Operations Research
5. Operation Research/H.A.Taha/TMH
6. Optimization in operations research/R.LRardin

Reference Books:

1. Optimization theory & Applications/S.SRao/NewAge International
2. Introductory to operation research/Kasan & Kumar/Springar
3. Optimization Techniques theory and practice/M.C Joshi, K.M Moudgalya/N arosa Publications..
4. S.DSharma/Operations Research
5. Operation Research/H.A.Taha/TMH
6. Optimization in operations research/R.LRardin

Online Learning Resources:

https://nptel.ac.in/courses/112/101/112101298

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

FOOD PRESERVATION TECHNIQUES

I M.Tech– I Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
24G3D17103c	PE-I	3	0	0	3	40	60	100

Course Objectives:

- Locate and appraise legislative requirements or authoritative guidelines relevant to shelf life extension in fresh, minimally processed and processed foods.
- Recognize the elements of theHazard Analysis Critical Control Point (HACCP) system
- Identify the principles of preservation processes Operate or observe equipment used in preservation processes with an understanding of the mechanism of preservation employed and the effects of the individual unit operations.
- Apply principles of food preservation to pilot scale production of processed food and evaluate variation in processing parameters or product formulation on product properties
- Prepare for practical exercises, organise team work and reflect on issues arising from practical exercise(s) and or production simulation(s) utilising the communication tools
- Identify and examine the method of packaging, packaging materials and storage practices employed in shelf life extension of fresh, minimally processed and processed foods.
- Recognise and analyse spoilage symptoms in fresh, minimally processed and processed foods and relate same to the causes of food spoilage.

Course Out comes:A student after completion of the course will be able to

CO1:	Participation in practical sessions in the pilot plant and laboratory culminating with the submission of a scientific report with feedback on your prac performance and reporting
CO2:	Submission of a literature review assignment on a topic of significance and relevance to the area of study with feedback on your selection, review and critical appraisal of literature.
CO3:	A two hour closed book final examination at the end of the semester that will address specific learning outcomes
CO4:	Discussion on Fruit juice concentrations
CO5:	Participation in Practical sessions on Refrigerated ware house

UNIT-I: Theories and Method of Chilling, Freezing Methods
Theories and method of chilling, freezing and free de-humidification – preparation for freezing, freezing methods: commercial freezing methods – sharp, quick and air blast freezing, freeze- drying. Methods of pre-cooling fruits and vegetables – hydrocooling, forced air cooling and vacuum cooling
UNIT II: Processing of meat products
Processing of meat products: Refrigeration systems for carcass chilling and holding – chilled brine spray, sprayed coil – dry coil systems, chilling and freezing variety meats – overnight chilling, quick chilling, effect of freezing temp on qualify of meat product Fishery products: icing of fish –saltwater icing, freezing methods –slow freezing, blast freezing, plate freezing and immersion freezing of fish.
UNIT-III: Dairy products
Dairy products :Milk processing, handling, dairy plant procedure, standardizing,

pasteurization, homogenizing, and container filling
UNIT-IV: Fruit juice concentrations
Fruit juice concentrations: Processing and quality control – selection, grading and handling of fresh fruit, washing, juice extraction, heat treatment, flavor fortification, packaging storage and distribution- convection methods-freezing and mechanical separation, low temperature vacuum evaporation, direct refrigerant contact method, indirect refrigerant contact methods, and high temperature short time evaporations.
UNIT-V: Refrigerated ware house
Refrigerated warehouse: factors affecting ware house design- building location, design reduction, shipping and receiving plant forms, utility space, controlled atmospheric storage rooms, jacketed storages, automated ware house – insulation, cold storage doors. Refrigerated trucks, trailers & containers: temperature control methods, body design & construction, auxiliary Equipment, types of refrigeration systems-railway refrigeration cars.

Textbooks:

1. ASHRE-Guide and data book
2. Refrigeration & Air-conditioning-C.P.Arora
3. Hand Book of Air conditioning system design –Carrier

Reference Books:

1. ASHRE-Guide and data book
2. Refrigeration & Air-conditioning-C.P.Arora
3. Hand Book of Air conditioning system design –Carrier

Online Learning Resources:

- http://ecoursesonline.iasri.res.in/course/view.php?id=639

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

PRINCIPLES OF AIR-CONDITIONING

I M.Tech– I Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
24G3D17104a	PE-II	3	0	0	3	40	60	100

Course Objectives:

- Will understand well, the importance of maintaining the thermal environment for human comfort which ultimately enhances the working efficiency.
- Will be in a position to understand the necessity of maintaining the temperature and humidity for various processes in process and pharmaceutical industries.
- Will become fully aware of the techniques for controlling the contamination of environment which is a must for modern A C systems.

Course Out comes: A student after completion of the course will be able to

CO1:	Define the need and importance of HVAC, handling of different HVAC systems
CO2:	Describe thermal comfort, its principles and practices, clothing and activities and their impact on comfort and productivity
CO3:	Interpret ventilation impact on human comfort, productivity and health.
CO4:	Propose Psychometric application to HVAC engineering and design different HVAC systems.
CO5:	Explain air and water/refrigerant flow inducts and pipes,duct and piping design, air distribution in rooms.
CO6:	Paraphrase control of HVAC systems-automatic and manual, different control systems used.

UNIT-I: Psychrometry
Psychrometric: Properties of Moist air-Psychrometric relations –Psychometric chart - Psychrometric processes in air-conditioning equipment - Bypass factor - Sensible heat factor APPLIED PSYCHROMETRY: Effective and grand sensible heat factors- Selection of Air Conditioning apparatus for cooling and dehumidification-High latent cooling load applications- All outdoor air application.
UNIT II: Air-conditioning Processes
Processing of meat products: Refrigeration systems for carcass chilling and holding – chilled brine spray, sprayed coil – dry coil systems, chilling and freezing variety meats – overnight chilling, quick chilling, effect of freezing temp on qualify of meat product Fishery products: icing of fish –saltwater icing, freezing methods –slow freezing, blast freezing, plate freezing and immersion freezing of fish.
UNIT-III: Process of Cooling, Heating and Dehumidifying coils
Process of Cooling, Heating and Dehumidifying coils –air washers –Cooling by dry and wet coils - use of hygroscopic solution in air washers - Adiabatic dehumidifier – Humidifier-water injection - steam injection. Heat pump - Different heat pump circuits air, ground water, earth - The linked air Cycle heat pump-solar energy collections –Drying of materials.
UNIT-IV: Requirements of Comfort Air-conditions
Requirements of Comfort Air-conditions-Thermodynamics of human body-Body regulation process against heat or cold - comfort and comfort chart - Effective temperature - Factors governing optimum effective temperature -Design considerations- Selection of outside and Inside design conditions..

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

UNIT-V: Ventilation systems
Ventilation systems: Natural ventilation system - Mechanical - Extraction system - Supply system - Combined supply and extraction system - Air-cleaning - Equipment used for odour suppression and air sterilization. Air-conditioning controls systems - basic elements of the control systems - temperature, humidity and pressure controls and refrigeration flow controls - room thermostat.

Textbooks:

1. Hand Book of Air conditioning system design –Carrier
2. Refrigeration & Air-conditioning-C.P.ARORA,TMGH,2000.
3. Refrigeration & Air-conditioning--DomkundwarandArora,DanpatRai&Sons,2000.
4. Refrigeration & Air-conditioning--Stoecker.
5. Refrigeration & Air-conditioning-V.K.Jain.
6. ASHRE-Guide and data book

Reference Books:

1. Hand Book of Air conditioning system design –Carrier
2. Refrigeration & Air-conditioning-C.P.ARORA,TMGH,2000.
3. Refrigeration & Air-conditioning--DomkundwarandArora,DanpatRai&Sons,2000.
4. Refrigeration & Air-conditioning--Stoecker.
5. Refrigeration & Air-conditioning-V.K.Jain.
6. ASHRE-Guide and data book

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc19_me58/preview

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

CRYOG ENICENGINEERING

I M.Tech– I Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
24G3D17104b	PE-II	3	0	0	3	40	60	100

Course Objectives:

- Examine basic principles of cryogenics
- Apply the knowledge of cryogenics in different applications of cryogenics like space technology, gas industry, electronics
- Design low temperature system by considering properties and principles of mixtures
- Identify theoretical and mathematical methods of liquefactionsystems
- Construction of liquefaction system for different gases.

Course Out comes: A student after completion of the course will be able to

CO1:	Acquire knowledge about cryogenics and properties of cryogenic fluid
CO2:	Recognize the liquefaction systems for different gases
CO3:	Apply theoretical and mathematical methods of liquefaction system
CO4:	Design low temperature system by considering properties and principles of mixtures
CO5:	Understand and demonstrate the insulation required for fluid storage and transfer
CO6:	Apply the knowledge of cryogenic fluid storage and transfer systems

UNIT-I: Introduction necessity of low temperature
Introduction necessity of low temperature-Multistage Refrigeration system-Cascade system-Manufacture of dry ice-Joule Thompson coefficient. Liquification of air - Lindae system-Analysis-Dual pressure cycle analysis-Liquefaction of Hydrogen and Helium-problems.
UNIT II: Application of Lower temperature
Application of Lower temperature-Effects on the properties of metals-strength-Thermal properties super conductivity-super fluidity. Applications like expansion fitting - cryobiology-cryosurgery -space research-computers underground power lines.
UNIT-III: Low temperature insulation
Low temperature insulation-Reflective insulation-Evacuated powders-Rigid foams-Super insulation
UNIT-IV: Cooling by a diabatic de-magnetization
Cooling by a diabatic de-magnetization-Gas separation and cryogenic systems-separation of gases Rectifying columns-Air separating- single and double columns Air separation plant.
UNIT-V: Storage and handling of cryogenic liquids
Storageand handling of cryogenic liquids –Dewars and other types of containers

Textbooks:

1. Cryogenics by Barron.OxfordUniversityPress2019.
2. Cryogenic Engineering by Timmer haus
3. Cryogenic Engineering by Huston: McGraw Hill
4. Refrigeration and Air-conditioning by S.Domkundwar

Reference Books:

1. Cryogenics by Barron.OxfordUniversityPress2019.
2. Cryogenic Engineering by Timmer haus
3. Cryogenic Engineering by Huston: McGraw Hill
4. Refrigeration and Air-conditioning by S.Domkundwar

Online Learning Resources:

1. www.nasa.gov
2. www.cryogenicsociety.org/
3. www.iifiir.org/
4. www.linde.com
5. www.airliquide.com/
6. www.cern.ch

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

SOLAR REFRIGERATION AND AIR-CONDITIONING

I M.Tech– I Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D17104c	PE-II	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100

Course Objectives:

- To understand thermo dynamic relations.
- To understand energy and irreversibility.
- To understand different types of solar cooling systems
- To understand the thermodynamic modeling
- To understand the Economics of different cooling systems

Course Out comes: A student after completion of the course will be able to

CO1:	To be able to state the Psychometric and (Air-conditioning) cooling load calculations-outline of Vapour Compression Refrigeration Systems.
CO2:	To be able to identify and describe energy Principle of vapour Absorption Refrigeration, steam jet refrigeration, thermoelectric refrigeration.
CO3:	To be able to explain at a level understandable by a non-technical person how various P.V. Modules. Solar operated vapour absorption systems.
CO4:	To be able to apply the Solar thermal energy storage.
CO5:	To be able to perform Simulation of solar thermal systems –Salient features of DYNSYS, TRNSYS.

UNIT-I: Review of Psychometric and cooling load calculations
Review of Psychometric and (Air-conditioning) cooling load calculations-outline of Vapour Compression Refrigeration Systems – Cycle on p-h and T-o charts – C.O.P – Simple problems using property tables.
UNIT II: Principle of working of various Refrigeration Systems
Principle of working of vapour Absorption Refrigeration, steam jet refrigeration, thermo electric refrigeration–classification of refrigerants–Desirable properties of ideal refrigerant –Properties of solvent-Solvent refrigerant combination properties.
UNIT-III: Solar cooling systems
Solar cooling systems: vapour compression systems, Rankine cycle, Striling cycle, using P.V.Modules.SolarSolarthermalenergystorageoperatedvapourabsorptionsystems–vapour jet refrigeration systems.
UNIT-IV: Solar thermal energy storage
Solar thermal energy storage-Active and passive systems TROMBE wall–equivalent thermal circuit-Solar greenhouses. Solar cooling and dehumidification: Desiccant cooling-Solid and liquid desiccants-improving desiccant cycles - hybrid systems.
UNIT-V: Non–mechanical systems
Non –mechanical systems - Australian Rock system – Solar assisted Heat Pump – Economics of solar cooling systems. Simulation of solar thermal systems - Salient features of DYNSYS, TRNSYS – model formulation – flow diagram of cooling systems.

Textbooks:

1. Cryogenics by Barron.OxfordUniversityPress2019.
2. Cryogenic Engineering by Timmer haus
3. Cryogenic Engineering by Huston: McGraw Hill
4. Refrigeration and Air-conditioning by S.Domkundwar

Reference Books:

5. Cryogenics by Barron.OxfordUniversityPress2019.
6. Cryogenic Engineering by Timmer haus
7. Cryogenic Engineering by Huston: McGraw Hill
8. Refrigeration and Air-conditioning by S.Domkundwar

Online Learning Resources:

7. www.nasa.gov
8. www.cryogenicsociety.org/

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

REFRIGERATION LABORATORY

I M.Tech– I Semester								SJCET-R24
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
24G3D17105	**PC**	0	0	4	2	40	60	100

Course Objectives:

- To make student understand working of various machines related to refrigeration and their energy efficiency related performance
- To explain student working of various components of refrigeration systems

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

CO1:	Analyze the performance Domestic Vapor Compression Refrigeration system
CO2:	Evaluate the performance of the Vapor compression and Air conditioning units
CO3:	Analyze the Expansion devices
CO4:	Evaluate the performance of capacity and cop. Of evaporative condensing test rig.

List of Experiments

S.No.	Title of the Experiment
1.	Find out the Cop. And time taken for ICE making in the Domestic Vapor Compression Refrigeration.
2.	Study on Compressor unit.
3.	Find out the pull-down characteristics of V.C.R.S.
4.	Study of Condenser unit
5.	Find out the c.o.p. of vapor Absorption Refrigeration system
6.	Study on Expansion devices.
7.	Find out the cooling capacity and cop. Of evaporative condensing test rig.
8.	Study on Evaporating device.

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

HEAT TRANSFER LABORATORY

I M.Tech– I Semester								SJCET-R24
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
24G3D17106	**PC**	0	0	4	2	40	60	100

Course Objectives:

- Understand the various forms of heat transfer and their applications in real life problems.
- Analyze different methods to calculate the heat transfer coefficient in various heat transfer problems.

Analyze the theoretical knowledge and apply it in conducting experiments in the forms of heat transfer.

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

CO1:	Perform steady state conduction experiments to estimate thermal conductivity of different materials for plane, cylindrical and spherical geometries Perform the transient heat conduction experiment and obtain variation of temperature along the
CO2:	Length of the pin fin. Estimate heat transfer coefficients in forced convection, free convection and determine
CO3:	Effectiveness of heat exchangers Perform radiation experiments: determine surface emissivity of a test plane and Stefan Boltzmann's constant and compare with theoretical values
CO4:	Estimate heat transfer coefficients in condensation, boiling and effectiveness of heat pipe

List of Experiments

S.No.	Title of the Experiment
1.	Thermal conductivity of insulating powder material through Concentric Sphere apparatus.
2.	Thermal conductivity of insulating material through lagged pipe apparatus
3.	Overall heat transfer co-efficient through Composite Slab Apparatus
4.	Thermal Conductivity of metal (conductor).
5.	Heat transfer in pin-fin
6.	Experiment on Transient Heat Conduction
7.	Heat transfer coefficient in forced convection.
8.	Heat transfer coefficient in natural convection
9.	Emissivity of a gray body through Emissivity apparatus.
10.	Experiment on Critical Heat flux apparatus.
11.	Study of heat pipe and its demonstration.
12.	Study of Two–Phase flow.

References:

1. Yunus A. Engel , “Heat Transfer a Practical Approach”,TataMcGraw-HillEducation,4th Edition,2012.

2. R.C.Sachdeva,“Fundamentals of Engineering , Heat and Mass Transfer”, New Age publication,3 rd Edition, 2012. Web Refer Online learning resources/Virtual labs:

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

RESEARCH METHODOLOGY AND IPR

I M.Tech– I Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
24G3DRM101	MC	2	0	0	2	40	60	100

Course Objectives:

- Identify an appropriate research problem in their interesting domain.
- Understand ethical issues understand the Preparation of a research project thesis report
- Understand the Preparation of a research project thesis report
- Understand the law of patent and copy rights.
- Understand the Adequate knowledge on IPR

Course Out comes: A student after completion of the course will be able to

CO1:	Analyze research related information
CO2:	Follow research ethics
CO3:	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity
CO4:	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
CO5:	Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits To be able to state the Psychometric and (Air-conditioning) cooling load calculations-outline of Vapour Compression Refrigeration Systems.

UNIT-I: Meaning of research problem
Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, scope, and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations
UNIT II: Effective literature studies approaches
Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee
UNIT-III: Nature of Intellectual Property
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT
UNIT-IV: Patent Rights
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.
UNIT-V: New Developments in IPR
New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies of IPR.

Textbooks:

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

Reference Books:

1. Ranjit Kumar, 2nd Edition, "Research Methodology :A Step by Step Guide for beginners"
3. Halbert, "Resisting Intellectual Property", Taylor & amp; Francis Ltd, 2017. Mayall," Industrial Design", McGraw Hill ,2012.
4. Niebel, "Product Design", McGraw Hill, 2014.
5. Asimov, "Introduction to Design", Prentice Hall, 2002.
6. RobertP.Merges, PeterS. Menell, MarkA. Lemley, "Intellectual Property in New Technological Age", 2016.

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

ENGLISH FOR RESEARCH PAPER WRITING

M.Tech– I Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
24G3DAC101a	AC-I	2	0	0	0	40	00	40

Course Objectives:

- Understand the essentials of writing skills and their level of readability
- Learn about what to write in each section
- Ensure qualitative presentation with linguistic accuracy

Course Out comes: A student after completion of the course will be able to

CO1:	Understand the significance of writing skills and the level of readability
CO2:	Analyze and write title, abstract, different sections in research paper
CO3:	Develop the skills needed while writing a research paper
CO4:	Develop the Key skills needed for writing a Title
CO5:	Understand the Appropriate language to formulate Methodology

UNIT-I: Overview of a Research Paper
Overview of a Research Paper-Planning and Preparation-Word Order-Useful Phrases – Breaking up Long Sentences-Structuring Paragraphs and Sentences-Being Concise and Removing Redundancy - Avoiding Ambiguity
UNIT II: Essential Components of a Research Paper
EssentialComponentsofaResearchPaper-Abstracts-BuildingHypothesis-ResearchProblem- Highlight Findings- Hedging and Criticizing, Paraphrasing and Plagiarism, Cauterization
UNIT-III: Introducing Review of the Literature
Introducing Review of the Literature–Methodology-Analysis of the Data-Findings–Discussion Conclusions-Recommendations.
UNIT-IV: Key skills needed for writing a Title
Key skills needed for writing a Title, Abstract, and Introduction
UNIT-V: Appropriate language to formulate Methodology
Appropriate language to formulate Methodology, incorporate Results, put forth Arguments and draw Conclusions

SuggestedReading

1. GoldbortR (2016) Writing for Science, Yale University Press (available on Google Books) Model Curriculum of Engineering & Technology PG Courses [Volume-I]
2. DayR (2016) How to Write and Publish a Scientific Paper, Cambridge University Press
3. High manN(2018),Hand book of Writing for the Mathematical Sciences, SIAM. Highman's book
4. Adrian Wall work, English

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

DISASTER MANAGEMENT

M.Tech– I Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
24G3DAC101b	AC-I	2	0	0	0	40	00	40

Course Objectives:

- Learn to demonstrate critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk education and humanitarian response policy and practice from multiple perspectives.
- Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations
- Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

Course Out comes: A student after completion of the course will be able to

CO1:	Understand the significance of Disaster Management
CO2:	Analyze the Repercussions of Disasters and Hazards
CO3:	Understand the Disaster Preparedness and Management
CO4:	Understand the Risk Assessment Disaster Risk
CO5:	Understand the Disaster Mitigation

UNIT-I: Introduction: Disaster
Introduction: Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude. Disaster Prone Areas in India: Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post- Disaster Diseases and Epidemics
UNIT II: Repercussions of Disasters and Hazards
Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Melt down, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.
UNIT-III: Disaster Preparedness and Management
Disaster Preparedness and Management: Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk:Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.
UNIT-IV: Risk Assessment Disaster Risk
Risk Assessment Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.
UNIT-V: Disaster Mitigation
Disaster Mitigation: Meaning, Concept and Strategies of Disaster Mitigation , Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India

Suggested Reading

1. R.Nishith, Singh AK, “Disaster Management in India: Perspectives, issues and strategies
2. “’New Royal book Company. Sahni, Pardeep Et. Al.(Eds.), ”Disaster Mitigation Experiences And Reflections”, Prentice Hall Of India, New Delhi.
3. GoelS.L.,Disaster Administration And Management Text And Case Studies”, Deep & Deep Publication Pvt. Ltd., New Delhi

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

SANSKRIT FOR TECHNICAL KNOWLEDGE

M.Tech – I Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3DAC101c	AC-I	L	T	P	C	CIA	SEE	Total
		2	0	0	0	40	00	40

Course Objectives:

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge
- Knowledge from ancient literature

Course Out comes: A student after completion of the course will be able to

CO1:	Understanding basic Sanskrit language
CO2:	Ancient Sanskrit literature about science & technology can be understood
CO3:	Being a logical language will help to develop logic in students
CO4:	Understanding Technical information about Sanskrit Literature
CO5:	Understanding Technical concepts of Engineering

UNIT-I:
Alphabets in Sanskrit,
UNIT II:
Past/Present/Future Tense, Simple Sentences
UNIT-III:
Order Introduction of roots
UNIT-IV:
Technical information about Sanskrit Literature
UNIT-V:
Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Suggested Reading

1. "Abhya spustakam"–Dr.Vishwas,Sanskrit-BhartiPublication,NewDelhi
2. "Teach Yourself Sanskrit "Prathama Deeksha Vempati Kutumb shastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication

"India's Glorious Scientific Tradition"Suresh Soni, Ocean books (P)Ltd., New Delhi

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

DESIGN OF AIR-CONDITIONING SYSTEMS

I M.Tech– II Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
24G3D17201	PC	3	0	0	2	40	60	100

Course Objectives:

- Understand the environmental and social impact of old and alternative refrigerants.
- Ability to design and select the various components of refrigeration systems.
- Ability to carry out thermodynamic analysis of multi pressure, cryogenic and other nonconventional refrigeration systems.
- Ability to carry out heat load calculation

Course Out comes: A student after completion of the course will be able to

CO1:	Analyze and understand the design of the air-distribution Room air distribution –types of supply air outlets plants.
CO2:	Thorough knowledge of the basic design principles of building survey & cooling load estimation.
CO3:	Location of equipment power plants.
CO4:	Understand the economic, environmental, and regulatory issues related to central station air conditioning system.
CO5:	Understand applications of air-conditioning Industrial, commercial, transport air conditioning Analyze research related information.

UNIT-I: AIR-DISTRIBUTION
Room air distribution - types of supply air outlets - Mechanism of flow through outlets – Considerations for selection and location of outlets - Distribution patterns of outlets friction loss in ducts- grills, diffusers - registers - location of outlets and return air opening - friction loss in ducts - Rectangularequivalentsofcircularducts-Airductsdesign:ductconstruction-Ductdesign procedures- Equal Friction, Static Regain, Velocity Reduction methods
UNIT II: BUILDING SURVEY & COOLING LOAD ESTIMATION:
Location of equipment and-Heat gain through glass-Shading from reveals, overhangs and fins-Effect of shading device-Calculation of Solar heat gain through ordinary glass using tables, Fabric heat gain, overall heat transfer coefficient, periodic heat transfer through walls and roofs- solar temperature-Empirical methods to calculate heat transfer through walls and roofs using decrement factor and time lag-Equivalent temperature difference method-Infiltration-Stack effect-wind action load due to infiltration. COOLINGLOADESTIMATION: Occupancy load, lighting load, appliance load-Product load-system heat gains-cooling and heating load estimates-Heat storage, diversity and stratification.
UNIT-III: AIR CONDITIONING SYSTEMS:-
Central station Air conditioning system-All water, all air, air water -unitary, Split, district Air conditioning systems.
UNIT-IV: THERMAL INSULATION & AIR HANDLING APPARATUS
Method of Heat transfer, desired properties of ideal insulating materials, types of insulating materials, Heat transfer through insulation, economic thickness of insulation, insulation of heated Buildings, insulation for cooling Buildings and cold storage, pipe insulation. Fans and Blowers-types of Fans-Fan characteristics-Centrifugal Fans-Axial Fans-Fan arrangements- Filters- general service – Noise -

sources &control
UNIT-V: APPLICATIONS OF AIR-CONDITIONING
APPLICATIONSOFAIR-CONDITIONING:- Industrial,Commercial,transportAirconditioning- Special applications-Computer, Hospital Cold storages, Printing, Textile & Leather industries.

Textbooks:

1. Hand Book of Air conditioning system design –Carrier
2. Refrigeration & Air-conditioning-C.P.ARORA, TMGH,2016.
3. Refrigeration & Air-conditioning–Domkund war and Arora, Danpat Rai & Sons, 2016."

Reference Books:

1. Refrigeration & Air-conditioning-Stoecker.
2. Refrigeration & Air-conditioning-V.K.Jain.
3. ASHRAE-Guide and Data Book

Online Learning Resources:

- https://www.free-education.in/hvac-design-and-drafting-course-online-free/
- https://www.usbr.gov/tsc/techreferences/mands/mands-pdfs/HVACManl.pdf

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

CONVECTIVE HEAT & MASS TRANSFER

I M.Tech– II Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
24G3D17202	PC	3	0	0	3	40	60	100

Course Objectives:

- To understand the convective heat transfer.
- To ability to forced convection heat transfer in laminar tube flow.
- To understand boiling and condensation
- To understand mass transfer.
- To familiarize Convective mass transfer-governing equations.

Course Out comes: A student after completion of the course will be able to

CO1:	Understand the hydro dynamic, thermal boundary layer concept and the relationship between fluid friction and heat transfer.
CO2:	Understand the concept and mechanism of forced and natural convection.
CO3:	Understand the mass transfer theories.
CO4:	Ability to apply the various empirical correlations used in different fluid flow situations.
CO5:	Ability to analyze and solve complex heat transfer phenomenon.
	Ability to design the heat exchangers for various industrial applications

UNIT-I: Introduction to convection
Introduction to convection, review of conservation equations –Forced convection in laminar flow- Exact and approximate solutions of Boundary layer energy equation for plane isothermal plate in longitudinal flow - problems.
UNIT II: Forced convection heat transfer in laminar tube flow
Forced convection heat transfer in laminar tube flow –forced convection in turbulent flow–Internal Flows-Correlations-Problems. Approximate analysis of laminar free convective heat transfer on a Vertical plate-external flows-correlations-problem.
UNIT-III: Boiling and condensation
Boiling and condensation: Analysis of film condensation on a vertical surface –pool boiling-forced convection boiling inside tubes – problems
UNIT-IV: Mass Transfer
Definitions of concentration and velocities relevant to mass transfer, Fick's law, species conservation equation in different forms. Steady state diffusion in dilute solutions in stationary media, transient diffusion in dilute solutions in stationary media, one dimensional non dilute diffusion in gases withone component stationary.
UNIT-V: Convective mass transfer
Convective mass transfer - governing equations-forced diffusion from flat plate-Dimension less correlation's for mass transfer. Simultaneous heat and mass transfer – analogy between heat, mass and momentum transfer.

Textbooks:

1. Heat transfer-J.P. Holman.
2. Heat and Mass transfer-R.C. Sachdeva

Reference Books:

1. Convective Heat and Mass transfer- Kays .
2. Heat and Mass transfer -V. Gupta and I. Srinivasan –Tata Mc.Graw Hill

Online Learning Resources:

- https://nptel.ac.in/courses/112/106/112106170/

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

REFRIGERATION EQUIPMENT & CONTROLS

I M.Tech– II Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D17203a	PE-III	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100

Course Objectives:

- To understand the principles of Compressors -types-equivalent shaft work.
- To understand different Condensers.
- To know Evaporator systems.
- To gain knowledge about Expansion devices.
- To know Performance of complete Vapour compression system.

Course Out comes: A student after completion of the course will be able to

CO1:	To be able to state principles of Compressors- types- equivalent shaft work.
CO2:	To be able to identify and describe Condensers, types, Water cooled Condensers-Air cooled, Evaporative types..
CO3:	To be able to explain at a level understandable by a non-technical person how various Evaporators work.
CO4:	To be able to apply the Expansion devices within the system.
CO5:	To be able to apply evaluation and dehydration testing for leakages, charging, adding oil. Understand the hydro dynamic, thermal boundary layer concept and the relationship between fluid friction and heat transfer.

UNIT-I: Compressors andt ypes
Compressors-types-equivalent shaft work-Volumetric efficiency-factors affecting total volumetric efficiency- compound compression with inters cooling-rotary compressors-surging-Screw compressors-lubricating oils.
UNIT II: Condensers and types
Condensers -types –Water cooled Condensers-Air cooled, Evaporative types -Economic water rate - Economic water velocity - over all heat transfer co-efficient - design - temperature distribution and heat flow in a condenser - pressure drop - fouling factor - LMTD correction factor (no problems). Cooling towers and spray ponds -classification -performance of cooling towers - analysis ofcounter flow cooling towers - enthalpy - temperature diagram of air and water - cooling ponds - types - cross flow cooling towers - procedure for calibration of outlet conditions.
UNIT-III: Evaporators and types
Evaporators - types - Flooded and dry Evaporators, natural and forced convection type -shell and tube - shell and coil, plate type - secondary Evaporators - temperature distribution and heat flow in evaporator-pressure drop-fouling correction factor(no problems). Defrosting-necessity-method- manual, automatic, periodic defrosting, solid and liquid adsorbents, water defrosting, defrosting by reversing the cycle, automatic hot gas defrosting, thermo balance defrosting, electric control defrosting. (Only theory)
UNIT-IV: Expansion devices
Expansion devices-Capillary tube, thermostatic expansion valve –float valves, externally equalized valves - automatic expansion valves - solenoid control valve - location of piping and pump design consideration.(Only theory)
UNIT-V: Performance of complete Vapour compression system
Performance of complete Vapour compression system-Performance of condensing unit-compressor - Evaporator-balancing of load in two stage compression.(no problems) Installation of vapour compression refrigeration system-evaluation and dehydration

testing for leakages -charging-adding oil.(Only theory)

Textbooks:

1.'Refrigeration and Air Conditioning'- by Stoecker–TMGH–International Edition,2002
2.'Refrigeration and Air Conditioning'- by Domkundwar–Dhanpat Rai & Co.,-2018
3.'Refrigeration and Air Conditioning' -by- C.P.Arora–TMGH-2017
4.ASHRAE Guide and Data book applications.

Reference Books:

1.'Refrigeration and Air Conditioning'- by Stoecker–TMGH–International Edition, 2002
2.'Refrigeration and Air Conditioning'- by Domkundwar– Dhanpat Rai & Co.,-2018
3. 'Refrigeration and Air Conditioning' -by- C.P.Arora–TMGH-2017
4. ASHRAE Guide and Data book applications.

Online Learning Resources:

- http://ecoursesonline.iasri.res.in/course/view.php?id=418

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

DESIGN OF HEAT TRANSFER EQUIPMENT

I M.Tech– II Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D17203b	PE-III	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100

Course Objectives:

- To understand the design of heat exchangers.
- To understand design of evaporators and compressors.
- To know design of cooling towers and spray ponds.
- To gain knowledge about design of ducts and fans
- To know piping system..

Course Out comes: A student after completion of the course will be able to

CO1:	To be able to state the Exchangers-mean temperature differences for parallel and counter flow Effectiveness method.
CO2:	To be able to identify Temperature distribution and heat flow in an evaporator-pressure drop factor to be consider in the design of heat transfer equipment.
CO3:	To be able to explain Classification-performance of cooling towers –analysis of counter flow cooling towers- enthalpy-temperature diagram of air and water.
CO4:	To be able to explain design of cooling towers and spray ponds
CO5:	To be able to explain Requirements of a good piping system-pressure dropin pipes-moody chart refrigerant piping

UNIT-I: Design of Heat Exchangers and Design of Condensers

DESIGN OF HEAT EXCHANGERS:

Exchangers-mean temperature differences for parallel and counter flow- effectiveness method (N.T.U)-keys and London charts.

DESIGNOFCONDENSERS:

Types overall heat transfer coefficients- temperature distribution and heat flow in a condenser pressure drop in a condenser –extended fin surfaces-consideration of fouling factor-L.M.T.D. correction factor..

UNIT II: Design of Evaporators and Design of Compressors

DESIGNOFEVAPORATORS:

Temperature distribution and heat flow in an evaporator-pressure drop-factor to be considering the design of heat transfer equipment-types of heat consideration of fouling factor –correction factor

DESIGN OF COMPRESSORS:

Types-equivalent shaft work-volumetric efficiency-factors affecting total volumetric efficiency– compound compression with inter cooling- rotary compressors-surging.

UNIT-III: Design of Cooling Towers and Spray Ponds

DESIGNOFCOOLINGTOWERSANDSPRAYPONDS:

Classification-performance of cooling towers – analysis of counter flow cooling towers-enthalpy temperature diagram of air and water- cooling ponds- types of cooling ponds –cross flow cooling towers- procedure for calculation of outlet conditions.)

UNIT-IV: Design of Ducts and Design of Fans

DESIGNOFDUCTS:

Continuity equation-Bernoulli's equation-pressure losses-frictional charts- coefficient of resistance for fillings- duct sizing methods.

DESIGNOFFANS:

Standard air-fan horsepower-fan efficiency-similarity laws-fan laws-performance

coefficients theoretical expression for total pressure drop by a fan-centrifugal fan-axial flow fan-system resistance.
UNIT-V: Piping System
PIPINGSYSTEM: Requirements of a good piping system-pressure drop in pipes-moody chart-refrigerant piping discharge line-liquid line-suction line-piping arrangement

Textbooks:

1. Heat and mass transfer by Arora & Dom kundwar.
2. Refrigeration & Air-Conditioning by P.L.Ballaney
3. Refrigeration & Air-Conditioning by C.P.Arora.
4. Refrigeration & Air-Conditioning by Stoecker

Reference Books:

1. Heat and mass transfer by Arora & Dom kundwar.
2. Refrigeration & Air-Conditioning by P.L.Ballaney
3. Refrigeration & Air-Conditioning by C.P.Arora.
4. Refrigeration & Air-Conditioning by Stoecker

Online Learning Resources:

- https://nptel.ac.in/courses/112/105/112105248/

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

ADVANCED THERMAL STORAGE TECHNOLOGIES

I M.Tech– II Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D17203c	PE-III	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100

Course Objectives:

- To Understand The Necessity Of Thermal Storage–Types-EnergyStorageDevices
- To Understand Sensible Heat Storage System.
- To Know Parallel Flow And Counter Flow Regenerators.
- To Gain Knowledge About Specific Areas Of Application Of Energy Storage.
- Latent Heat Storage Systems.

Course Out comes: A student after completion of the course will be able to

CO1:	To be able to state the types-energy storage devices–comparison of energy storage technologies.
CO2:	To be able to identify and describe Basic concepts and modeling of heat storage units -modeling of simple water and rock bed storage system.
CO3:	To be able to explain at a level understandable by a non-technical person how various Parallel flow and counter flow regenerators.
CO4:	To be able to calculate Modeling of phase change problems
CO5:	Tobe able to explain green house heating–power plant applications –drying and heating for process industries.

UNIT-I: INTRODUCTION
INTRODUCTION Necessity of thermal storage –types-energy storage devices–comparison of energy storage technologies - seasonal thermal energy storage - storage materials.
UNIT II: SENSIBLE HEAT STORAGE SYSTEM
SENSIBLE HEAT STORAGE SYSTEM Basic concepts and modeling of heat storage units - modeling of simple water and rock bed storage system – use of TRNSYS – pressurized water storage system for power plant applications – packed beds.
UNIT-III: REGENERATORS
REGENERATORS Parallel flow and counter flow regenerators – finite conductivity model – non – linear model – transient performance – step changes in inlet gas temperature – step changes in gas flow rate – parameterization of transient response – heat storage exchangers
UNIT-IV: LATENT HEAT STORAGE SYSTEMS
LATENT HEAT STORAGE SYSTEMS Modeling of phase change problems –temperature based model –enthalpy model – porous medium approach - conduction dominated phase change – convection dominated phase change
UNIT-V: APPLICATIONS
APPLICATIONS Specific areas of application of energy storage – food preservation – waste heat recovery – solar energy storage – green house heating – power plant applications – drying and heating for process industries.

Textbooks:

1.Ibrahim Dincer and Mark A.Rosen,Thermal Energy Storage Systems and Applications, John Wiley & Sons 2002.

Reference Books:

1.Schmidt. F.W and Willmott.A .J, Thermal Storage and Regeneration, Hemisphere Publishing Corporation, 2011.
2.Lunardini.V. J,Heat Transfer in Cold Climates, John Wiley and Sons 2011

Online Learning Resources:

- http://iitk.ac.in/cce/courses/2019/TES/

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

ADVANCED FLUID MECHANICS

I M.Tech– II Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
24G3D17204a	PE-IV	3	0	0	3	40	60	100

Course Objectives:

- Establish and understanding of the fundamental concepts of fluid mechanics.
- Understand and apply the potential flow equations to basic flows.
- Understand and apply the differential equations of fluid mechanics including the ability to apply and understand the impact of assumptions made in the analysis.
- Understand the boundary layer concepts with respect to fluid flow
- Understand and apply the compressible flow equations.

Course Out comes: A student after completion of the course will be able to

CO1:	Apply knowledge of mathematics, science and engineering.
CO2:	Derive the governing equations of fluid flow and applying them to simple flow problems
CO3:	Emphasizing the mathematical formulation of various flow problems.
CO4:	Apply the boundary layer concept to the fluid flow problems

UNIT-I: Basic concepts
Basic concepts: Continuum hypothesis – Eulerian and Lagrangian descriptions. Derivation of general differential equations – continuity momentum and energy of incompressible flow- Navier Stokes equation for Viscous Fluids (Rectangular Co-Ordinate Systems)-Euler's equations for ideal fluids- Bernoulli's equations (one dimensional) – applications
UNIT II: Laminar Flow Viscous In compressible Fluids
Laminar Flow Viscous Incompressible Fluids: Flow similarity – Reynolds number, flow between parallel flat plates, couette-flow, plane poiseuille flow, Hagen – poiseuille flow. Laminar boundary layer: Boundary layer concept,Prandtl's approximations, Blassius solution for a flat plate without pressure gradient – momentum integral equation – Von-Kerman integral relation – Pohlhausen method of obtaining approximate solutions. Displacement thickness, momentum thickness and energy thickness. Boundary layer separation and control, Kerman's integral equation
UNIT-III: Introduction to turbulence
Introduction to turbulence: Origin of turbulence, nature of turbulent flow–Reynolds equations and Reynolds stresses, velocity profile. Compressible Fluid Flow Basics: Mach number, Flow pattern in compressible flow, classification of compressible flow, isentropic flow, stagnation properties
UNIT-IV: Gas Dynamics
Gas Dynamics: Compressible flow through ducts and nozzles –area velocity relations. Flow through convergent and convergent divergent nozzles. Real nozzles flow at design conditions. Introduction to normal compression shock – normal shock relations. Introduction to Fan no Raleigh equations
UNIT-V: Flow in ducts with friction
Flow in ducts with friction: Fannoline, adiabatic constant area-Flow of perfect gas, chocking due to friction in constant area flow- Introduction to constant area flow with heat transfer (Raleigh line)

Textbooks:

1. YuanS.W. "Foundations of Fluid Mechanics", Prentice Hall–Eastern economy edition 2013
2. Zucrwo M.J. and Hoffman J.D."Gas Dynamics", Vol-I & Vol-II, John Wiley and SonsInc. 2017

Reference Books:

1. Yahya S.M."Fundamentals of Compressible Flow",-Wiley Eastern4
2. Young, Munsen and Okiisyi, "A Brief Introduction to Fluid Mechanics" 2nd Edition, John Wiley 2000.
3. Frank. M. White, "Fluid Mechanics 5th Edn–McGraw Hill 2005.

Online Learning Resources:

- https://nptel.ac.in/courses/112/105/112105218/

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

DESIGN OF HVAC SYSTEM

I M.Tech– II Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
24G3D17204b	PE-IV	3	0	0	3	40	60	100

Course Objectives:

- •To understand the principles of Applied Psychrometry, Psychrometric processes using chart Load Estimation.
- To understand Air Distribution.
- To know Ventilation and Infiltration.
- To gain knowledge about Direct and Indirect Evaporative Cooling.
- To impart knowledge on Air conditioning systems.

Course Out comes: A student after completion of the course will be able to

CO1:	•To be able to state the Applied Psychrometry, Psychrometric processes using chart Load Estimation.
CO2:	To be able to identify and describe Fundamentals of airflowin ducts, pressure drop calculations, design ducts by velocity reduction method
CO3:	To be able to explain at a level understandable by a non-technical person how Requirement of ventilation air, various sources of infiltration air, ventilation and infiltration as a part of cooling load.
CO4:	To be able to apply the Basic psychometric of evaporative cooling, types of evaporative coolers, design calculations.
CO5:	To be able to apply Classification, design of central and unitary systems, typical air conditioning systems such as automobile, air plane, ships.

UNIT-I: Applied Psychrometry
Applied Psychrometry, Psychrometric processes using chart Load Estimation: solar heat gain, study of various sources of the internal and external heat gains, heat losses, etc. Methods of heat load calculations: Equivalent temperature Difference Method, Cooling Load Temperature Difference, and Radiance Method, RSHF, GSHF, ESHF, etc. Inside and outside design conditions.
UNIT II: Air Distribution
Air Distribution: Fundamentals of air flow in ducts, pressured rop calculations, design ducts by velocity reduction method, equal friction method and static regain method, duct materials and properties, insulating materials, types of grills, diffusers, wall registers.
UNIT-III: Ventilation and Infiltration
Ventilation and Infiltration: Requirement of ventilation air, various sources of infiltration air, ventilation and infiltration as a part of cooling load. Fans and Blowers: Types, performance characteristics, series and parallel arrangement, selection procedure.
UNIT-IV: Direct and Indirect Evaporative Cooling
Direct and Indirect Evaporative Cooling: Basic psychometric of evaporative cooling, types of evaporative coolers, design calculations, Air Conditioning Equipments and Controls: Chillers, Condensing units, Cooling coils, bypass factors, humidifiers, dehumidifiers, various types of filters, air washers, thermostat, humidistat, cycling and sequence controls, modern control of parity, odour and bacteria, Air filtration-Study of different types of filters, Cooling Towers
UNIT-V: Air conditioning systems
Air conditioning systems: Classification, design of central and unitary systems, typical

air conditioning systems such as automobile, air plane, ships, railway coach air-conditioning, warm air system, hot water systems, heat pump, clean rooms (descriptive treatments only). Standards and Codes: ASHRAE/ARI, BIS standards study and interpretation, ECBC, NBC codes

Textbooks:

1. ASHRAE Hand books
2. ISHRAE Hand book.
3. Hand book of Air Conditioning System Design, Carrier Incorporation, McGraw Hill Book Co., USA.
4. Trane air conditioning manual,
5. Refrigeration and Air conditioning, ARIP renticeHall, NewDelhi.

Reference Books:

1. 1.NormanC.Harris, Modern air conditioning
2. Jones W.P., Air conditioning Engineering, Edward Arnold Publishers Ltd, London, 1984.
3. Jones W.P., Air conditioning Engineering-Applications, Edward ArnoldPublishers Ltd, London, 1984
4. Hainer R.W., Control System for Heating, Ventilation and Air conditioning, Van Nastr and Reinhold Co., New York, 1984. New Delhi.
6. Mc Quiston, Faye; Parker, Jerald; Spitler, Jeffrey 2000,Heating,Ventilating and Air Conditioning -Analysis and Design, 5th ed. John Wiley & Sons.

Online Learning Resources:

- http://www.mecciengineer.com/hvac-design.aspx

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

ENERGYCONSERVATIONANDMANAGEMENT

I M.Tech– II Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D17204c	PE-IV	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100

Course Objectives:

- To understand the principles of energy conservation.
- To understand thermal insulation & refractors.
- To know waste heat recovery systems.
- To gain knowledge about engineering economics.
- To impart knowledge Energy management programs.

Course Out comes: A student after completion of the course will be able to

CO1:	Ability to understand the basic concept of energy conservation and its role in energy management.
CO2:	Learn the purpose and detailed methodology of energy audit.
CO3:	Ability to analyze the energy conservation opportunities in the energy intensive industries.
CO4:	Ability to analyze the quantum of electrical energy that can be saved by the use of energy efficient lighting systems.
CO5:	Learn the concept of cogeneration, trigeneration and waste heat recovery in detail.

UNIT-I: ENERGY CONSERVATION

ENERGY CONSERVATION:

Rules for efficient energy conservation –technologies for energy conservation –outline of waste heat and material reclamation, load management, alternate energy sources, and energy storage.

UNIT II: THERMAL INSULATION & REFRACTORS

THERMALINSULATION&REFRACTORS:

Heat loss through un-insulated surfaces, effects of insulation on current carrying wires – economic thickness of insulation–critical radius of insulation–properties of thermal insulators–classification of insulation materials – classification of refractors – properties of refractors – criteria for good refractory material–applications of insulating & refractory materials.

UNIT-III: WASTE HEAT RECOVERY SYSTEMS

WASTE HEAT RECOVERY SYSTEMS:

Guideline to identify waste heat–feasibility study of waste heat –shell and tube heat exchanger – thermal wheel – heat pipe heat exchanger – heat pump – waste heat boilers – incinerators.

HEAT RECOVERY SYSTEMS & HEAT EXCHANGER NETWORKS: Liquid to liquid heat exchangers–gas to liquid heat recovery systems, regenerators, recuperators, rotating regenerators – miscellaneous heat recovery methods – selection of materials for heat exchangers – combined radiation and convective heat exchanger, U-tube heat exchanger, tube heat exchanger, fluidized bed heat exchanger – economizer

UNIT-IV: ENGINEERING ECONOMICS

ENGINEERINGECONOMICS:

Managerial objectives, steps in planning – efficiency of organization- capital budgeting – classification of costs – interest – types – nominal and effective interest rates – discrete and continuous compounding – discounting - time value of money – cash flow diagrams – present worth factor, capital recovery factor, equal annual payments – equivalent between cash flows.

ENERGY AUDITING:
A definition –objectives –level of responsibility – control of energy– uses of energy– checklists– energy conservation schemes – energy index – cost index – pie charts – sankey diagrams – load profiles – types of energy audits – questionnaire – energy audit of industries – general energy audit – detailed energy audit – energy saving potential.

UNIT-V: PROJECTMANAGEMENT

PROJECTMANAGEMENT:
Method of investment appraisal – rate of return method, pay back method, net present value method (NPV) – adoption of the methods in energy conservation campaign – types of projects — propose of project management – classification – role and qualities of project manager – types of budgets -budget committee – budgeting.

ENERGYMANAGEMENTPROGRAMS:
Necessary steps of energy management programme – concepts of energy management – general principles of energy management – energy management in manufacturing and process industries – qualities and functions of energy managers – duties of energy manager- language of energy manager– checklist for top management.

Textbooks:

1. Waste heat recovery systems -D.A. Reay/Pergmon Press
2. Hand book of energy audits-Albert Thumann
3. Energy Management-W.R. Murphy & G. Mickay, Butterworths
4. Energy Conservation-P.W. O'Callaghan, Pargamon Press 2011

Reference Books:

1. Waste heat recovery systems-D.A.Reay/Pergmon Press
2. Engineering Heat Audits-C.P.Gupta & Rajendra Prakash, Nechand & Bros.
3. Hand book of energy audits-Albert Thumann, The F.Airmont Press Inc., Atlanta Georgia, 2019.
4. Energy Management Principles-Craig B. Smithm, Pergarmon Press
5. Therols of Energy Manger -EEO.,U.K.
6. Industrial Engineering & Management-Dr.O.P.Khanna,DhanapatRai&Sons,2012
7. 'PERT–CPM'-L.S.Srinath

Online Learning Resources:

- https://nptel.ac.in/courses/112/105/112105221/

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

AIR-CONDITIONING LABORATORY

I M.Tech– II Semester								SJCET-R24
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
24G3D17205	**PC**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	0	4	2	40	60	100

Course Objectives:

- To understand Humidification and Dehumidification process.
- To understand Gas charging unit.
- To know various process and by-pass factor by using Air conditioning test Rig.
- To gain knowledge on Air-condition system. Split–Air conditioning system and Central Air conditioning system.
- To understand over-all efficiency of cooling Tower.

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

CO1:	Ability to apply the theoretical knowledge to solve problems in Heat Power Engineering.
CO2:	Hands on experience through actual experimentation or simulation.
CO3:	Ability to formulate and analyze practical problems.
CO4:	Ability to prepare mathematical/geometrical model and solve it using appropriate software
CO5:	Ability to analyzed at a obtained through experimentation/simulation and drawing suitable
CO6:	Technical conclusion
CO7:	Ability to prepare technical report for the given case study.

List of Experiments

S.No.	Title of the Experiment
1.	Study the Humidification and Dehumidification process.
2.	Find out the Efficiency of the Air-washer test rig.
3.	Study on Gas charging unit
4.	Find out over-all efficiency of cooling Tower.
5.	Find out the capacity and by-pass factor of the window air conditioning.
6.	Study the various process and by-pass factor by using Air conditioning test Rig
7.	Study on Heat pump
8.	Study on Air-condition system. Split–Air conditioning system and Central Air conditioning system

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

ADVANCED FLUID MECHANICS LAB

I M.Tech– II Semester								SJCET-R24
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
24G3D17206	**PC**	0	0	4	2	40	60	100

Course Objectives:

Student will be able to make the students understand the fluid flow concepts and get familiarity with flow measuring devices.

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

CO1:	Student will able to understand course to make the students understand the fluid flow concepts and get familiarity with flow measuring devices
CO2:	Calibration of Orifice meter
CO3:	Determination of Coefficient of discharge for a small orifice by a constant head method.
CO4:	Calibration of contracted Rectangular Notch and/or Triangular Notch.
CO5:	Impact of jet on vanes

List of Experiments

S.No.	Title of the Experiment
1.	Calibration of Venturi meter
2.	Calibration of Orifice meter
3.	Determination of Coefficient of discharge for a small orifice by a constant head method.
4.	Determination of Coefficient of discharge for an external mouth piece by variable head method..
5.	Calibration of contracted Rectangular Notch and/or Triangular Notch
6.	Determination of Coefficient of loss of head in a sudden contraction and friction factor.
7.	Verification of Bernoulli's equation.
8.	Impact of jet on vanes.
9.	Study of Hydraulic jump.
10.	Performance test on Pelton wheel turbine.
11.	Performance test on Francis turbine.
12.	Efficiency test on centrifugal pump

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

PEDAGOGY STUDIES

AUDIT COURSE-II

I-M.Tech – II Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
24G3DAC201a	AC	2	0	0	0	40	00	40

Course Objectives:

- Review existing evidence on their view topic to inform programme design and policy making undertaken by the Df ID, other agencies and researchers.
- Identify critical evidence gaps to guide the development

Course Out comes: A student after completion of the course will be able to

CO1:	What pedagogical practices are being used by teachers inform a land informal classrooms in developing countries?
CO2:	What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
CO3:	How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?
CO4:	Understanding Technical concepts of Engineering

UNIT-I: Introduction and Methodology
Introduction and Methodology: Aims and rationale, Policy back ground, Conceptual frame work and Terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching.
UNIT II: Thematic overview
Thematic overview: Pedagogical practices are being used by teacher's informal and informal classrooms in developing countries. Curriculum, Teacher education.
UNIT-III: Evidence on the effectiveness of pedagogical practices
Evidence on the effectiveness of pedagogical practices, Methodology for the in-depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' Attitudes and beliefs and Pedagogic strategies.
UNIT-IV: Professional development
Professional development: alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: Limited resources and large classsizes
UNIT-V: Research gaps and future directions
Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

Suggested Reading

1.AckersJ, Hardman F(2001)Classroom interaction in Kenyan primary schools, Compare, 31(2):245-261.
2. Agrawal M(2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies,36(3):361-379.
4. Akyeampong K(2003)Teacher training in Ghana-does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
5. Akyeampong K, Lussier K, Pryor J, West brook J(2013)Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
6. Alexander RJ(2001) Culture and pedagogy: International comparisons in primary education.Oxford and Boston: Blackwell Chavan M(2003)Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

STRESS MANAGEMENT BY YOGA

AUDIT COURSE-II

I-M.Tech – II Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
24G3DAC201b	AC	2	0	0	0	40	00	40

Course Objectives:

- To achieve overall health of body and mind
- To overcome stress

Course Out comes: A student after completion of the course will be able to

CO1:	Develop healthy mind in a healthy body thus improving social health also
CO2:	Improve efficiency
CO3:	Do`s and Don't's in life.
CO4:	Asan and Pranayam
	Various yoga poses and their benefits for mind & body

UNIT-I:
Definitions of Eight parts of yoga.(Ashtanga)
UNIT II:
Yam and Niyam.
UNIT-III:
Do`s and Don't's in life. i)Ahinsa, satya, astheya, bramhacharya and aparigraha ii)Shaucha, santosh, tapa, swadhya, ishwar pranidhan
UNIT-IV:
Asana and Pranayam
UNIT-V:
i) Various yogposes and their benefits form ind & body ii) Regularization of breathing techniques and its effects-Types of pranayam

Suggested Reading

1. 'Yogic Asanas for Group Tarining-Part-I": Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature "by Swami Vivekananda, Advaita Ashrama (Publication Department),Kolkata

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

PERSONALITY DEVELOPMENT THROUGH LIFEENLIGHTENMENT SKILLS

AUDIT COURSE-II

I-M.Tech – II Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
24G3DAC201c	AC	2	0	0	0	40	00	40

Course Objectives:

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and Determination
- To awaken wisdom in students

Course Out comes: A student after completion of the course will be able to

CO1:	Study of Shrimad- Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
CO2:	The person who has studied Geeta will lead the nation and mankind to peace and prosperity
CO3:	Study of Neetishatakam will help in developing versatile personality of students
CO4:	Problem-solving: Students develop problem- solving kills
CO5:	Decision-making: Students learn effective decision-making skills

UNIT-I:
Neeti satakam-Holistic development of personality Verses-19,20,21,22(wisdom) Verses-29,31,32(pride & heroism) Verses-26,28,63,65(virtue)
UNIT II:
Neeti satakam-Holistic development of Personality Verses-52,53,59(dont's) Verses-71,73,75,78(do's)
UNIT-III:
Approach to day to day work and duties. ShrimadBhagwadGeeta:Chapter2-Verses41,47,48,Chapter3-Verses13,21,27,35,Chapter6-Verses5,13,17,23,35, Chapter18-Verses45,46,48.
UNIT-IV:
Statements of basic knowledge. Shrimad Bhagwad Geeta:Chapter2-Verses 56,62,68 Chapter12 -Verses13,14,15,16,17,18 Personality of Role model. Shrimad BhagwadGeeta:
UNIT-V:
Chapter 2-Verses17,Chapter 3-Verses 36,37,42, Chapter 4-Verses18,38,39 Chapter 18–Verses37,38,63

Suggested Reading

1. "Srimad Bhagavad Gita"by Swami Swarupananda Advaita Ashram(Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by .Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

DESIGN OF AIR HANDLING SYSTEMS

II-M.Tech – III Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
24G3D17301a	PE-V	3	0	0	3	40	60	100

Course Objectives:

- To understand basis concepts air-handling units
- To understand constant and variable volume systems.
- To know air system: components.
- To gain knowledge about ventilation for control of work environment.
- To acquire knowledge on Air controls.

Course Out comes: A student after completion of the course will be able to

CO1:	To be able to duct designstatic Regain-equal friction-T method.
CO2:	To be able to identify and describe Energy conservation and system retrofit.
CO3:	To be able to explain at a level understandable by a non-technical person how various Indoor Air Quality and Outside Air Requirements.
CO4:	To be able to justify Condensate control and Freeze-up protection
CO5:	To be able to apply various Demand control ventilations.

UNIT-I:
BASIS CONCEPTS Psychrometric, Classifications of Air-Handling Units, Main components, Selection of Air-Handling units, economizer cycle, single zone system, multi zone system-Design Consideration, duct designstatic Regain-equal friction-T method.
UNIT II:
CONSTANT AND VARIABLE VOLUME SYSTEMS Terminals reheat system, Double-Duct systems, Sub zone heating, Draw-through cooling, TripleDuct system, Fan Coil Unit, Induction system. Various System Configurations -Hydronic heat pump, Heat recovery and Economizer, Indirect evaporative cooling, Energy conservation and system retrofit.
UNIT-III:
AIR SYSTEM: COMPONENTS Fan-types, Construction, Arrangement, and Selection, Coil Characteristics and Accessories, Condensate control and Freeze-up protection
UNIT-IV:
VENTILATION FOR CONTROL OF WORK ENVIRONMENT Ventilation, Measurements control and exhaust, Air cleaning devices, Rating and Assessments, Test method for air filters, and replacement-Air system, evaluation and control of the thermal Environment, Indoor Air Quality and Outside Air Requirements
UNIT-V:
AIR CONTROLS Demand control ventilations, Thermostats, Damper and damper motor, Automatic Valves, Direct digital control, Application of fuzzy logic & neural network-Demand control ventilation.

Textbooks:

1. Ysen - Yao Sun, Air handling system design, McGraw–Hill, Inc., NY – 1994
2. William A. Burges, Michael j. Ellen Becker, Robert D. Treitman, Ventilation for control of the work environment, A Wiley - Interscience Publication NY - 1989.

3. John I. Levenhagen, Donald H. Spethmann, HVAC controls and systems, McGraw – Hill international Edition. NY - 1992. Allan T. Kirkpatrick & James S. Elleson, cold air distribution system design guide, ASHEAC - 1996 USA.

Reference Books:

1. Shan K.Wang, Handbook of Air-conditioning and Refrigeration, McGraw -Hill, 2001.
2. SMACNA, HVAC System Duct Design, SMACNA Virginia - 1990.

Online Learning Resources:

- https://www.tpctraining.com/products/air-handling-systems
- https://www.trox.de/ (design manual)

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

INDOOR AIR QUALITY CONTROL

M.Tech – III Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
24G3D17301b	PE-V	3	0	0	3	40	60	100

Course Objectives:

- To impart knowledge on the principles and design of control of indoor/particulate/gaseous air pollutant and its emerging trends.
- To understand air filtration.
- To know air pollution–indoor, outdoor; statistics in india.
- To gain knowledge about design of clean rooms.
- IAQ measurements & control.

Course Out comes: A student after completion of the course will be able to

CO1:	Apply sampling techniques
CO2:	Apply modeling techniques
CO3:	Suggest suitable air pollution prevention equipments and techniques for various gaseous and particulate pollutants to Industries. Discuss the emission standards

UNIT-I:
AIR QUALITY Air Pollution–Indoor, Outdoor; statistics in India-Contaminants-sources-effects of air quality on health and productivity-IAQ-ASHRAE standards.
UNIT II:
AIR QUALITY & SICK BUILDING SYNDROME Effect of temperature , Velocity , Pressure , Humidity on IAQ-Noise-Source-damping methods-Air distribution-diffuser design-location-air charge calculations-age of air-SBS- psycho social effectsParameters causing SBS-Bio contaminants-diagonising Building problems-NIOSH standards.
UNIT-III:
AIR FILTRATION Principles of air filtration-impingement filters, HEPA & ULPA filters, Electronic air cleaners, filters Filter Standards-filter efficiency-filter testing methods-NAFA certification.
UNIT-IV:
DESIGN OF CLEANROOMS History of clean rooms-classification-clean room standards-different contaminants-ISO classification-interiors-Recommended practices-Design of clean rooms for Hospitals, Pharmaceutical, microelectronic, Bio technology food industries and manufacture industries International standards
UNIT-V:
IAQ MEASUREMENTS & CONTROL Contaminants measurement-sampling sampling methods-Quality assurance calibration- data interpretation-instruments-specifications-source control–prevention-Dilution Ventilation- demand control volume method.

Textbooks:

1. Whyte W. Clean Room Design II Edition, John Wiley & Sons (NY)–1999.

Reference Books:

1. American Institutes of Architects (AIA) , Guidelines for Design & Construction of Hospital & Health care facilities , AIA, Washington–2001.

2. Thad Godish , Sick Buildings , Lecois Publishers , Ann Arbor , 1994.
3. National Air Filtration Association, NAFA guide to Air Filtration-III edition-NAFA Washington DC-2001.
4.ASHRAE Hand Book, HVAC Systems and Equipment, I-P Edition 1996.

Online Learning Resources:

- https://www.epa.gov/indoor-air-quality-iaq/introduction-indoor-air-quality
- https://www.wfinstitute.com/post/air-filtration-training-course

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

COGENERATION AND WASTE HEAT RECOVERY SYSTEMS

II-M.Tech – III Semester							SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks	
		L	T	P	C	CIA	SEE	Total
24G3D17301c	PE-V	3	0	0	3	40	60	100

Course Objectives:

- The basic energy generation cycles
- The concept of cogeneration, its types and probable areas of applications
- Significance of waste heat recovery systems and carry out its economic analysis

Course Out comes: A student after completion of the course will be able to

CO1:	Analyse the basic energy generation cycles
CO2:	Do the economic analysis of waste heat recovery systems

UNIT-I:

Introduction – principles of thermodynamics – cycles – topping – bottoming – combined cycle – organic rankine cycles – performance indices of cogeneration systems – waste heat recovery – sources and types – concept of tri generation.

UNIT II:

CONGENERATION TECHNOLOGIES

Configuration and thermodynamic performance – steam turbine congeneration systems – gas turbine cogeneration systems – reciprocating IC engines cogeneration systems – combined cycles cogeneration systems – advanced cogeneration systems: fuel cell, Stirling engines etc.,

UNIT-III:

ISSUES AND APPLICATIONS OF COGENERATION TECHNOLOGIES

Cogeneration plants electrical interconnection issues – utility and cogeneration plant interconnection issues – applications of cogeneration in utility sector – industrial sector – building sector – rural sector – impacts of cogeneration plants – fuel, electricity and environment.

UNIT-IV:

WASTE HEAT RECOVERY SYSTEMS

Selection criteria for waste heat recovery technologies – recuperators – Regenerators – economizers – plate heat exchangers – thermic fluid heaters – Waste heat boilers – classification, location, service conditions, design Considerations – fluidized bed heat exchangers – heat pipe exchangers – heat pumps – sorption systems.

UNIT-V:

ECONOMIC ANALYSIS

Investment cost – economic concepts – measures of economic performance – procedure for economic analysis – examples – procedure for optimized system selection and design – load curves – sensitivity analysis – regulatory and financial frame work for cogeneration and waste heat recovery systems.

Textbooks:

1. Charles H. Butler, Cogeneration, McGraw Hill Book Co., 1984.11
2. EDUCOGEN – The European Educational tool for cogeneration, Second Edition, 2001

Reference Books:

1. Horlock JH, Cogeneration - Heat and Power, Thermodynamics and Economics, Oxford,1987.
2. Institute of Fuel, London, Waste Heat Recovery, Chapman & Hall

Publishers,London, 1963.
3. Seagate Subrata, Lee SS EDS, Waste Heat Utilization and Management, Hemisphere, Washington, 1983.
4. De Nevers, Noel., Air Pollution Control Engineering, McGrawHill, New York,1995

Online Learning Resources:

- https://nptel.ac.in/courses/112/105/112105221/
- https://www.udemy.com/course/waste-heat-recovery/

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

BUSINESS ANALYTICS

II-M.Tech – III Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
24G3DOE301c	OE	3	0	0	3	40	60	100

Course Objectives:

- The main objective of this course is to give the student a comprehensive understanding of business analytics methods.

Course Out comes: A student after completion of the course will be able to

CO1:	Students will demonstrate knowledge of data analytics.
CO2:	Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
CO3:	Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making
CO4:	Students will demonstrate the ability to translate data into clear, actionable insights.

UNIT-I:
Business Analysis: Overview of Business Analysis, Overview of Requirements, Role of the Business Analyst. Stakeholders: the project team, management, and the front line, Handling Stakeholder Conflicts.
UNIT II:
Life Cycles: Systems Development Life Cycles, Project Life Cycles, Product Life Cycles, Requirement Life Cycles.
UNIT-III:
Forming Requirements: Overview of Requirements Attributes of Good Requirements, Types of Requirements, Requirement Sources, Gathering Requirements from Stakeholders, Common Requirements Documents. Transforming Requirements: Stakeholder Needs Analysis, Decomposition Analysis, Additive/Subtractive Analysis, Gap Analysis, Notations (UML & BPMN), Flowcharts, Swim Lane Flowcharts, Entity-Relationship Diagrams, State-Transition Diagrams, Data Flow Diagrams, Use Case Modeling, Business Process Modeling.
UNIT-IV:
Finalizing Requirements: Presenting Requirements, Socializing Requirements and Gaining Acceptance, Prioritizing Requirements. Managing Requirements Assets: Change Control, Requirements Tools
UNIT-V:
Recent Trends in: Embedded and colleborative business intelligence, Visual data recovery, Data Storytelling and Data Journalism.

Textbooks:

1. Business Analysis by James Cadle et al.
2. Project Management: The Managerial Process by Erik Larson and, Clifford Gray

Reference Books:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education. Hemisphere, Washington, 1983.

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

INTERNET OF THINGS (IOT)

II-M.Tech – III Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
24G3DOE301g	OE	3	0	0	3	40	60	100

Course Objectives:

- To study fundamental concepts of IoT
- To understand roles of sensors in IoT
- To Learn different protocols used for IoT design
- To be familiar with data handling and analytics tools in IoT
- Appreciate the role of big data, cloud computing and data analytics in a typical IoT system

Course Out comes: A student after completion of the course will be able to

CO1:	Understand the various concepts, terminologies and architecture of IoT systems.
CO2:	Use sensors and actuators for design of IoT.
CO3:	Understand and apply various protocols for design of IoT systems
CO4:	Use various techniques of data storage and analytics in IoT.
CO5:	Understand various applications of IoT
CO6:	Understand APIs to connect IoT related technologies

UNIT-I:
Fundamentals of IoT: Introduction, Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, History of IoT, About Things in IoT, The Identifiers in IoT, About the Internet in IoT, IoT frameworks, IoT and M2M
UNIT II:
Sensors Networks : Definition, Types of Sensors, Types of Actuators, Examples and Working, IoT Development Boards: Arduino IDE and Board Types, RaspberriPi Development Kit, RFID Principles and components, Wireless Sensor Networks: History and Context, The node, Connecting nodes, Networking Nodes, WSN and IoT.
UNIT-III:
Wireless Technologies for IoT: WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE, Bacnet, Modbus. IP Based Protocols for IoT IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT. Edge connectivity and protocols
UNIT-IV:
Data Handling& Analytics: Introduction, Bigdata, Types of data, Characteristics of Big data, Data handling Technologies, Flow of data, Data acquisition, Data Storage, Introduction to Hadoop. Introduction to data Analytics, Types of Data analytics, Local Analytics, Cloud analytics and applications
UNIT-V:
Applications of IoT: Home Automation, Smart Cities, Energy, Retail Management, Logistics, Agriculture, Health and Lifestyle, Industrial IoT, Legal challenges, IoT design Ethics, IoT in Environmental Protection.

Textbooks:

1. Hakima Chaouchi, — “The Internet of Things Connecting Objects to the Web” ISBN : 978-1- 84821-140-7, Wiley Publications
2. Olivier Hersent, David Boswarthick, and Omar Elloumi, — “The Internet of Things: Key Applications and Protocols”, WileyPublications
3. Vijay Madisetti and ArshdeepBahga, — “Internet of Things (A Hands-on-

Approach)", 1st Edition, VPT, 2014.
4. J. Biron and J. Follett, "Foundational Elements of an IoT Solution", O'Reilly Media, 2016.
5. Keysight Technologies, "The Internet of Things: Enabling Technologies and Solutions for Design and Test", Application Note, 2016.

Reference Books:

1. Daniel Minoli, — "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publication
2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc17_cs22/course
- http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html

St. Johns College of Engineering and Technology

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

MECHATRONICS

II-M.Tech – III Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
24G3DOE301h	OE	3	0	0	3	40	60	100

Course Objectives:

- To study fundamental concepts of Signal condition
- To understand the concepts of precision mechanical systems
- To Learn different electronic interface subsystems
- To be familiar with microcontrollers overview.
- To understand the concepts of programmable logic controllers

Course Out comes: A student after completion of the course will be able to

CO1:	Understand the various concepts, terminologies of Signal condition
CO2:	Understand the basics electronic interface subsystems
CO3:	Understand and apply various precision mechanical systems
CO4:	Understand various applications of microcontrollers overview
CO5:	Understand the controlling of programmable logic and programmable motion.

UNIT-I:

INTRODUCTION: Definition – Trends - Control Methods: Standalone , PC Based (Real Time Operating Systems, Graphical User Interface , Simulation) - Applications: SPM, Robot, CNC, FMS, CIM.

SIGNAL CONDITIONING : Introduction – Hardware - Digital I/O, Analog input – ADC, resolution , speed channels Filtering Noise using passive components – Resistors, capacitors - Amplifying signals using OP amps – Software - Digital Signal Processing – Low pass , high pass , notch filtering.

UNIT II:

PRECISION MECHANICAL SYSTEMS : Pneumatic Actuation Systems - Electro-pneumatic Actuation Systems - Hydraulic Actuation Systems - Electro-hydraulic Actuation Systems - Timing Belts – Ball Screw and Nut - Linear Motion Guides - Linear Bearings - Harmonic Transmission - Bearings- Motor / Drive Selection.

UNIT-III:

ELECTRONIC INTERFACE SUBSYSTEMS : TTL, CMOS interfacing - Sensor interfacing – Actuator interfacing – solenoids , motors Isoation schemes- opto coupling, buffer IC's - Protection schemes – circuit breakers , over current sensing , resetable fuses , thermal dissipation - Power Supply - Bipolar transistors / mosfets

ELECTROMECHANICAL DRIVES : Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors - 4-quadrant servo drives , PWM's - Pulse Width Modulation – Variable Frequency Drives, Vector Drives - Drive System load calculation

UNIT-IV:

MICROCONTROLLERS OVERVIEW: 8051 Microcontroller , micro processor structure Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications. Programming –Assembly , C (LED Blinking , Voltage measurement using ADC)

UNIT-V:

PROGRAMMABLE LOGIC CONTROLLERS : Basic Structure - Programming : Ladder diagram -Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling Analog input / output - PLC Selection - Application.

PROGRAMMABLE MOTION CONTROLLERS : Introduction - System Transfer

Function Laplace transform and its application in analysing differential equation of a control system - Feedback Devices :Position , Velocity Sensors - Optical Incremental encoders - Proximity Sensors : Inductive , Capacitive ,

Textbooks:

1. A text book of Mechatronics by Er. R.K. RAJPUT. S.CHAND publications
2. A text book of Mechatronics by Nitalgour Premchand Mahalik ., McGraw Hill publications

Reference Books:

1. A text book of Mechatronics by W.Bolton ., Pearson Publications