AKTU B.E./B.Tech MECH Sem 6 syllabus

Refrigeration and Air Conditioning

REFRIGERATION & AIR CONDITIONING

Credits:1

Unit-1
Refrigeration:
Introduction to refrigeration system, Methods of refrigeration, Carnot refrigeration cycle, Unit of
refrigeration, Refrigeration effect & C.O.P.
Air Refrigeration cycle:
Open and closed air refrigeration cycles, Reversed Carnot cycle, Bell Coleman or Reversed Joule air
refrigeration cycle, Aircraft refrigeration system, Classification of aircraft refrigeration system. Boot
strap refrigeration, Regenerative, Reduced ambient, Dry air rated temperature (DART).

Unit-2
Vapour Compression System:
Single stage system, Analysis of vapour compression cycle, Use of T-S and P-H charts, Effect of
change in suction and discharge pressures on C.O.P, Effect of sub cooling of condensate &
superheating of refrigerant vapour on C.O.P of the cycle, Actual vapour compression refrigeration
cycle, Multistage vapour compression system requirement, Removal of flash gas, Intercooling,
Different configuration of multistage system, Cascade system.

Unit-3
Vapour Absorption system;

Working Principal of vapour absorption refrigeration system,

Comparison between absorption &
compression systems, Elementary idea of refrigerant absorbent mixtures, Temperature – concentration
diagram & Enthalpy – concentration diagram , Adiabatic mixing of two streams, Ammonia – Water
vapour absorption system, Lithium- Bromide water vapour absorption system, Comparison. Three fluid
system.

Refrigerants:
Classification of refrigerants, Nomenclature, Desirable properties of refrigerants, Common refrigerants,
Secondary refrigerants and CFC free refrigerants. Ozone layer depletion and global warming
considerations of refrigerants

Unit-4
Air Conditioning:
Introduction to air conditioning, Psychometric properties and their definitions, Psychometric chart,
Different Psychometric processes, Thermal analysis of human body, Effective temperature and comfort
chart, Cooling and heating load calculations, Selection of inside & outside design conditions, Heat
transfer through walls & roofs, Infiltration & ventilation, Internal heat gain, Sensible heat factor (SHF
), By pass factor, Grand Sensible heat factor (GSHF), Apparatus dew point (ADP). Air Washers,
Cooling towers & humidifying efficiency.

Unit-5
Refrigeration Equipment & Application:
Elementary knowledge of refrigeration & air conditioning equipmentse.g compressors, condensers,
evaporators & expansion devices, Food preservation, Cold storage, Refrigerates Freezers, Ice plant,
Water coolers, Elementary knowledge of transmission and distribution of air through ducts and fans,

Basic difference between comfort and industrial air conditioning.

MACHINE DESIGN-II

UNIT I

Principle of transmission and conjugate action

Spur Gears

Tooth forms, System of gear teeth, contact ratio, Standard proportions of gear systems, Interference in involute gears, Backlash, Selection of gear materials, Gear manufacturing methods, Design considerations, Beam strength of gear tooth, Dynamic tooth load, Wear strength of gear tooth, Failure of gear tooth, Design of spur gears, AGMA and Indian standards.

Helical Gears

Terminology, Proportions for helical gears, Forces components on a tooth of helical gear, Virtual number of teeth, Beam strength& wear strength of helical gears, Dynamic load on helical gears, Design of helical gears.

UNIT II Bevel gears

Terminology of bevel gears, Force analysis, Virtual number of teeth, Beam strength and wear strength of bevel gears,Effective load of gear tooth, Design of a bevel gear system.

Worm Gears

Types of worms, Terminology, Gear tooth proportions, Efficiency of worm gears, Heat dissipation in worm gearing, Strength and wear tooth load for worm gears, Design of worm gearing system.

UNIT III

Sliding Contact Bearing

Types, Selection of bearing, Plain journal bearing, Hydrodynamic lubrication, Properties and materials, Lubricants and lubrication, Hydrodynamic journal bearing, Heat generation, Design of journal bearing, Thrust bearing-pivot and collar bearing, Hydrodynamic thrust bearing,

UNIT IV

Rolling Contact Bearing

Advantages and disadvantages, Types of ball bearing, Thrust ball bearing, Types of roller bearing,
Selection of radial ball bearing, Bearing life, Selection of roller bearings, Dynamic equivalent load for
roller contact bearing under constant and variable loading, Reliability of Bearing, Selection of rolling
contact bearing, Lubrication of ball and roller bearing, Mounting of bearing

UNIT V

IC ENGINE parts,
Selection of type of IC engine, General design considerations, Design of cylinder and cylinder head;
Design of piston and its parts like piston ring and gudgeon pin etc.; Design of connecting rod; Design of
crankshaft

Books and References:

1. Design of Machine Elements-V.B. Bhandari, Tata McGraw Hill Co.
2. Machine Design-Sharma and Agrawal, S.K. Kataria& Sons.
3. Machine Design, U C Jindal, Pearson Eductaion.
4. Design of Machine Elements, Sharma and Purohit, PHI.
5. Design of Machine Eesign-M.F. Spott, Pearson Eductaion
6. Machine Design-Maleev and Hartman, CBS Publishers.
7. Mechanical Engineering Design, 9e – Joseph E. Shigely, McGraw Hill Education.
9. Elements of Machine Component Design, Juvinal&Marshek, John Wiley & Sons.

Cyber Security

Cyber Security

Introduction- Introduction to Information Systems, Types of Information
Systems, Development of Information Systems, Introduction to Information
Security, Need for Information Security, Threats to Information Systems,
Information Assurance, Cyber Security, and Security Risk Analysis.

Application Security- (Database, E-mail and Internet), Data Security
Considerations-Backups, Archival Storage and Disposal of Data, Security
Technology-Firewall and VPNs, Intrusion Detection, Access Control. Security
Threats -Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail
Viruses, Macro Viruses, Malicious Software, Network and Denial of Services
Attack, Security Threats to E-Commerce- Electronic Payment System, e- Cash,
Credit/Debit Cards. Digital Signature, Public Key Cryptography

Developing Secure Information Systems- Application Development
Security, Information Security Governance & Risk Management, Security
Architecture & Design Security Issues in Hardware, Data Storage & Downloadable Devices, Physical Security of IT Assets, Access Control, CCTV
and Intrusion Detection Systems, Backup Security Measures.

Security Policies- Development of Policies, WWW Policies, Email Security
Policies, Policy Review Process-Corporate Policies-Sample Security Policies,
Publishing and Notification Requirement of the Policies.
Evolving Technology Security – Mobile, Cloud, Outsourcing, SCM.

Information Security Standards-ISO, IT Act, Copyright Act, Patent Law,
IPR. Cyber Laws in India; IT Act 2000 Provisions, Intellectual Property Law:
Copy Right Law, Software License, Semiconductor Law and Patent Law.
Case Study – Corporate Security

Theory of Machines

Unit I

Introduction, mechanisms and machines, kinematics and kinetics, types of links, kinematic pairs and
their classification, types of constraint, degrees of freedom of planar mechanism, Grubler's equation,
mechanisms, inversion of four bar chain, slider crank chain and double slider crank chain.
Velocity analysis:
Introduction, velocity of point in mechanism, relative velocity method, velocities in four bar
mechanism, instantaneous center .
Acceleration analysis:
Introduction, acceleration of a point on a link, acceleration diagram, Corioli's component of
acceleration, crank and slotted lever mechanism,.

Unit II

Cams
Introduction, classification of cams and followers, cam profiles for knife edge, roller and flat faced
followers for uniform velocity, uniform acceleration,
Gears and gear trains
Introduction, classification of gears, law of gearing, tooth forms and their comparisons, systems of gear
teeth, length of path of contact, contact ratio, minimum number of teeth on gear and pinion to avoid
interference, simple, compound, reverted and planetary gear trains, sun and planet gear train.

Unit III

Force analysis:
Static force analysis of mechanisms, D'Alembert's Principle, dynamics of rigid link in plane
motion, dynamic force analysis of planar mechanisms, piston force and crank effort. Turning
moment on crankshaft due to force on piston, Turning moment diagrams for single cylinder
double acting steam engine, four stroke IC engine and multi-cylinder engines, Fluctuation of
speed, Flywheel.

Unit IV

Balancing:
Introduction,static balance, dynamic balance, balancing of rotating masses,two plane
balancing, graphical and analytical methods, balancing of reciprocating masses,
Governors:
Introduction, types of governors, characteristics of centrifugal governors, gravitycontrolled
and spring controlled centrifugal governors, hunting of centrifugal governors, inertia governors. Effort and Power of governor

Unit V

Brakes and dynamometers:
Introduction, Law of friction and types of lubrication, types of brakes, effect of braking on rear
and front wheels of a four wheeler, dynamometers, belt transmission dynamometer, torsion
dynamometer, hydraulic dynamometer

Text/Reference Books:
1. Kinematics and dynamics of machinery: Wilson and Sadler, Third edition, Pearson.
2. Theory of Mechanisms and Machines: AmitabhaGhosh and Ashok kumarMallik, Third
Edition Affiliated East-West Press.
3. Theory of Machines and Mechanisms: Joseph Edward Shigley and John Joseph
Uicker, Jr. Oxford University Press
4. Kinematics and dynamics of machinery: R L Norton, McGraw Hill
5. Theory of Mchines: S.S. Rattan, McGraw Hill
6. Theory of Mchines: Thomas Bevan, CBS Publishers.

INDUSTRIAL MANAGEMENT

INDUSTRIAL MANAGEMENT

Introduction: Concept and scope of Industrial Management.
Productivity:
Definition, measurement, productivity index, types of production system,
Industrial Ownership.

Functions of Management, Taylor's Scientific Management Theory, Fayol's
Principles of Management, Social responsibilities of Management, Introduction to Human resources management: Nature of HRM, functions and
importance of HRM.

Work Study: Introduction, definition, objectives, steps in work study, Method
study: definition, objectives, steps of method study, Work Measurement: purpose,
types of study — stop watch methods — steps — allowances — standard time
calculations — work sampling, Production Planning and Control
Inventory Control: Inventory, Cost, Models of inventory control: EOQ, ABC,
VED

Quality Control: statistical quality control, Control charts for variables and
attributes, Acceptance Sampling- Single sampling- Double sampling plans,
Introduction to TQM.

Project Management: Project network analysis, CPM, PERT and Project
crashing and resource Leveling

Sociology

Sociology

Industrial Sociology: Nature, Scope and Importance of Industrial Sociology.
Social Relations in Industry, Social Organisation in Industry- Bureaucracy,
Scientific Management and Human Relations.

Rise and Development of Industry: Early Industrialism – Types of Productive
Systems – The Manorial or Feudal system. The Guild system, The domestic or
putting-out system, and the Factory system. Characteristics of the factory system.

Causes and Consequences of industrialization. Obstacles to and Limitations of
Industrialization.

Industrialization in India. Industrial Policy Resolutions – 1956.Science.
Technology and Innovation Policy of India 2013.

Contemporary Issues: Grievances and Grievance handling Procedure. Industrial
Disputes: causes, Strikes and Lockouts. Preventive Machinery of Industrial
Disputes: Schemes of Workers Participation in Management- Works Committee,
Collective Bargaining, Bi-partite & Tri-partite Agreement, Code of Discipline,
Standing Orders. Labour courts & Industrial Tribunals.

Visualizing the future: Models of industrialization- Collectivist, anarchist, free
market, environmentalist, etc. Cultural issues, consumer society and sociological
concerns.

Fluid Machinery

UNIT-I

Introduction: Impulse of Jet and Impulse Turbines:
Classification of Fluid Machines & Devices, Application of momentum and moment of
momentum equation to flow through hydraulic machinery, Euler's fundamental equation.
Introduction to the hydrodynamic thrust of the jet on a fixed and moving surface (flat &curve),
Classification of turbines, Impulse turbines, Constructional details, Velocitytriangles, Power
and efficiency calculations, Governing of Pelton wheel

UNIT-II

Reaction Turbines:
Francis and Kaplan turbines, Constructional details, Velocity triangles, Power and efficiency
calculations, Degree of reaction, Draft tube, Cavitation in turbines,

Principles of similarity,
Unit and specific speed, Performance characteristics, Selection of water turbines.

UNIT-III
Centrifugal
Pumps:
Classifications of centrifugal pumps, Vector diagram, Work done by impellor, Efficiencies of
centrifugal pumps, Specific speed, Cavitation & separation, Performance characteristics.

UNIT-IV
Positive Displacement and other Pumps:
Reciprocating pump theory, Slip, Indicator diagram, Effect of acceleration, air vessels,
Comparison of centrifugal and reciprocating pumps, Performance characteristics.

UNIT-V
Hydraulic accumulator, Hydraulic intensifier, Hydraulic Press, hydraulic crane, hydraulic lift,
hydraulic Ram,hydraulic coupling, hydraulic torque converter, airlift pump, jet pump

COMPUTER BASED NUMERICAL TECHNIQUES

KOE 065: COMPUTER BASED NUMERICAL TECHNIQUES

Unit 1 Error and roots of Algrabraic and Transcendental Equations: Introduction of Numbers and their accuracy, Computer Arithmetic, Mathematical preliminaries, Errors and their Computation, General error formula, Error in a series approximation. Solution of Algebraic and Transcendental Equation: Bisection Method, Iteration method, Method of false position, Newton-Raphson method, Methods of finding real and complex roots, Muller's method, Rate of convergence of Iterative methods, Polynomial Equations.

Unit 2 Interpolation: Introduction Finite Differences, Difference tables Polynomial Interpolation: Newton's forward and backward formula Central Difference Formulae: Gauss forward and backward formula, Stirling's, Bessel's, Everett's formula. Interpolation with unequal intervals: Lagrange's Interpolation, Newton Divided

difference formula, Hermite's Interpolation.

Unit 3 Numerical Integration and Differentiation: Introduction: Numerical differentiation of Newton's forward and backward formula, Stirling's, Bessel's, Everett's formula, Lagrange's Interpolation and Newton Divided difference formula. Numerical Integration: Newton cotes formula, Trapezoidal rule, Simpson's 1/3 and 3/8 rules, Boole's rule, Waddle's rule.

Unit 4 Solution of differential Equations: Introduction, Picard's Method, Euler's Method, Taylor's Method, Runge-Kutta Methods, Predictor Corrector Methods, Automatic Error Monitoring and Stability of solution.

Unit 5 Boundary Value problems: Introduction, Finite difference method, solving Eigen value problems, polynomial method and power methods. Numerical solution of Partial Differential equations. Elliptic, Parabolic and hyperbolic PDEs. Distillation in a Plate Column, Unsteady-state Operation, Starting a Stirred-tank Reactor, Rate at which a Plate Absorber Approaches Steady State.

Text Books:

1. Jain, Iyengar and Jain, "Numerical Methods for Scientific and Engineering Computations", New Age International.
2. Grewal B S, "Numerical methods in Engineering and Science", Khanna Publishers, Delhi.

Reference Books

1. Rajaraman V, Computer Oriented Numerical Methods, Pearson Education
2. T Veerarajan, T Ramachandran, "Theory and Problems in Numerical Methods, McGraw Hill
3. Pradip Niyogi, Numerical Analysis and Algorithms, McGraw Hill.
4. Francis Scheld, Numerical Analysis, McGraw Hill.
5. Sastry S. S, Introductory Methods of Numerical Analysis, Pearson Education.
6. Kiusalaas, J.: Numerical methods in engineering with MATLAB, Cambridge University Press
7. Woodford, C and Phillips, C: Numerical methods with worked examples: MATLAB Edition, Springer

CONSTITUTION OF INDIA, LAW AND ENGINEERING

KNC501 CONSTITUTION OF INDIA, LAW AND ENGINEERING

Module 1-Introduction and Basic Information about Indian Constitution:
Meaning of the constitution law and constitutionalism, Historical Background of the Constituent Assembly, Government of India Act of 1935 and Indian Independence Act of 1947,Enforcement of the Constitution, Indian Constitution and its Salient Features, The Preamble of the Constitution, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Parliamentary System, Federal System, Centre-State Relations, Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India, Emergency Provisions: National Emergency, President Rule, Financial Emergency, and Local Self Government – Constitutional Scheme in India.

Module 2-Union Executive and State Executive:
Powers of Indian Parliament Functions of Rajya Sabha, Functions of Lok Sabha, Powers and Functions of the President, Comparison of powers of Indian President with the United States, Powers and Functions of the Prime Minister, Judiciary – The Independence of the Supreme Court, Appointment of Judges, Judicial Review, Public Interest Litigation, Judicial Activism, LokPal, Lok Ayukta, The Lokpal and Lok ayuktas Act 2013, State Executives – Powers and Functions of the Governor, Powers and Functions of the Chief Minister, Functions of State Cabinet, Functions of State Legislature, Functions of High Court and Subordinate Courts.

Module 3- Introduction and Basic Information about Legal System:
The Legal System: Sources of Law and the Court Structure: Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law, Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court). Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration. Contract law, Tort, Law at workplace.

Module 4-Intellectual Property Laws and Regulation to Information:
Intellectual Property Laws- Introduction, Legal Aspects of Patents, Filing of Patent Applications, Rights from Patents, Infringement of Patents, Copyright and its Ownership, Infringement of Copyright, Civil Remedies for Infringement, Regulation to Information-

Introduction, Right to Information Act, 2005, Information Technology Act, 2000, Electronic Governance, Secure Electronic Records and Digital Signatures, Digital Signature Certificates, Cyber Regulations Appellate Tribunal, Offences, Limitations of the Information Technology Act.

Module 5 -Business Organizations and E-Governance:
Sole Traders, Partnerships: Companies: The Company's Act: Introduction, Formation of a Company, Memorandum of Association, Articles of Association, Prospectus, Shares, Directors, General Meetings and Proceedings, Auditor, Winding up. E-Governance and role of engineers in E-Governance, Need for reformed engineering serving at the Union and State level, Role of I.T. professionals in Judiciary, Problem of Alienation and Secessionism in few states creating hurdles in Industrial development.

Suggested Readings:

• Brij Kishore Sharma: Introduction to the Indian Constitution, PHI, New Delhi, latest edition.
• Granville Austin: The Indian Constitution: Cornerstone of a Nation. 1966, Oxford Clarendon Press.
• Subhash C. Kashyap: Our Constitution: An Introduction to India's Constitution and constitutional Law, NBT, 2018.
• PM Bakshi: The Constitution of India, Latest Edition, Universal Law Publishing.
• V.K. Ahuja: Law Relating to Intellectual Property Rights (2007)
• Suresh T. Viswanathan: The Indian Cyber Laws, Bharat Law House, New Delhi-88
• P. Narayan: Intellectual Property Law, Eastern Law House, New Delhi
• Prabudh Ganguli: Gearing up for Patents: The Indian Scenario, Orient Longman.
• BL Wadehra: Patents, Trademarks, Designs and Geological Indications.Universal Law Publishing - LexisNexis.
• Intellectual Property Rights: Law and Practice, Module III by ICSI (only relevant sections)
• Executive programme study material Company Law, Module II, by ICSI (The Institute of Companies Secretaries of India) (Only relevant sections i.e., Study 1, 4 and 36).https://www.icsi.edu/media/webmodules/publications/Company%20
• Handbook on e-Governance Project Lifecycle, Department of Electronics & Information Technology, Government of India, https://www.meity.gov.in/writereaddata/files/e-Governance_Project_Lifecycle_Participant_Handbook-

5Day_CourseV1_20412.pdf

• Companies Act, 2013 Key highlights and analysis by PWC.https://www.pwc.in/assets/pdfs/publications/2013/companies-act-2013-key-highlights-and-analysis.pdf