# *Chhattisgarh Swami Vivekanand Technical University, Bhilai*

## SCHEME OF TEACHING AND EXAMINATION

## M. E. Mechanical Engineering (Thermal Engineering)

## III[rd] Semester

| S. No. | Board of Study | Sub. Code | SUBJECT | PERIODS PER WEEK | | | SCHEME OF EXAM Theory/Practical | | | TOTAL MARKS | Credit L+(T+P)/2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | ESE | CT | TA | | |
| 1. | Mechanical Engg | 564311 (37) | Computational Fluid Dynamics & Heat Transfer | 3 | 1 | , | 100 | 20 | 20 | 140 | 4 |
| 2. | Electives - III | | | 3 | 1 | , | 100 | 20 | 20 | 140 | 4 |
| 3. | Mechanical Engg | 564321 (37) | Preliminary work on Dissertation | , | , | 28 | 100 | , | 100 | 200 | 14 |
| 4. | Mechanical Engg | 564322 (37) | Seminar on Industrial Training and Dissertation | , | , | 3 | , | , | 20 | 20 | 2 |
| **Total** | | | | **6** | **2** | **31** | **300** | **40** | **160** | **500** | **24** |

**L – Lecture, T – Tutorial,**
**P – Practical, ESE, End Semester Exam**
**CT, Class Test TA – Teacher's Assessment**

**Table - I**

**List of Electives - III**

| Elective , I | | | |
|---|---|---|---|
| **S.No.** | **Board of Study** | **Subject Code** | **Subject** |
| 1 | Mechanical Engineering | 564331 (37) | Power Plant Engineerig |
| 2 | Mechanical Engineering | 564332 (37) | Cold Preservation of Food |
| 3 | Mechanical Engineering | 564333 (37) | Bio-Fluid Mechnics |
| 4 | Mechanical Engineering | 564334 (37) | Micro & Nano Scale Thermal Engineering |

# *Chhattisgarh Swami Vivekanand Technical University, Bhilai*

Semester: **III M.E (Thermal Engg.)** Branch: **Mechanical Engineering**
**Subject:** Computational Fluid Dynamics Heat Transfer **Code: 564311 (37)**
Total Theory Periods**: 40** Total Tutorial Periods: **12**
Total Marks in End Semester Exam. : **100**
**Minimum number of class test to be conducted:** 02

**Unit – I**
**Introduction**: Conservation equation mass momentum and energy equations convective forms of the equations and general description.

**Unit – II**
**Classification and Overview of Numerical Method:** Classification into various types of equation parabolic elliptic and hyperbolic boundary and initial conditions over view of numerical methods.

**Unit – III**
**Finite Difference Formulations**: Finite difference methods different means for formulating finite difference equation Taylor series expansion integration over element local function method finite volume methods central upwind and hybrid formulations and comparison for convection-diffusion problem treatment of boundary conditions boundary layer treatment various property interface accuracy of f.d. method.

**Unit – IV**
**Methods of Solution**: Solution of finite difference equations iterative methods matrix inversion methods ADI method operator splitting fast Fourier transform applications.

**Unit – V**
**Numerical Grid Generation**: Numerical grid generation basic ideas transformation and mapping.

**Finite Element Methods**: Finite element methods Rayleigh-Ritz, Galerkin and Least square methods interpolation function one and two dimensional elements applications.

**Phase Change Problem**: Phase change problem different approaches for moving boundary variable time step method enthalpy method

**Text Books:**

1. Anderson D.A. Tannehill, J.C. and R.H. “Computational Fluid Mechanics and Heat Transfer”. Taylor & Francis.1997
2. Roche P.J. “Computational Fluid Dynamics”, Hermosa New Mexico 1976


**References:**

1. Incropera F.P. and Dewitt, D.P. “Fundamentals of Heat and Mass Transfer”, Wiley N.Y. 1998
2. Patankar S.V. “Numerical Heat and Fluid Flow”, Hemisphere Washington D.C.1980
3. Zienkiewicz O.C. “The Finite Element Method in Engineering Science” McGraw Hill 1971
4. Shih T.M. “Numerical Heat Transfer”, Hemisphere Washington D.C.1984

# *Chhattisgarh Swami Vivekanand Technical University, Bhilai*

Semester: **III M.E (Thermal Engg.)** Branch: **Mechanical Engineering**
**Subject: Power Plant Engineering** **Code: 564331 (37)**
Total Theory Periods**: 40** Total Tutorial Periods: **12**
Total Marks in End Semester Exam. : **100**
**Minimum number of class test to be conducted:** 02

**UNIT – I**
Introduction to the Sources of Energy – Resources and Development of Power in India.
**Steam Power Plant:** Plant Layout, Working of different Circuits, Fuel and handling equipments, types of coals, coal handling, choice of handling equipment, coal storage, Ash handling systems.
**Steam Power Plant:** COMBUSTION PROCESS: Properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, Dust collectors, cooling towers and heat rejection. Corrosion and feed water treatment.

**UNIT II**
**Gas Turbine Plant**: Introduction – classification - construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and comparison.

**UNIT – III**
**Cogeneration**: What is Cogeneration, Why Cogeneration, Application of Cogeneration, The Benefits of Cogeneration, Steam Turbine Cogeneration System, Gas Turbine Cogeneration System, Reciprocating Engine Cogeneration System, Classifications of Cogeneration Systems, topping cycle cogeneration systems, Bottoming cycle, Assesment of cogeneration system Calculations For Steam Turbine Cogeneration System, Energy Efficiency Opportunities in Steam Turbine Cogeneration System, Energy Efficiency Opportunities in a Gas Turbine Cogeneration System, Economics of Cogeneration,

**UNIT IV**
**Power from Non-Conventional Sources**: Utilization of Solar- Collectors- Principle of Working,
**DIRECT ENERGY CONVERSION**: Solar energy, Fuel cells, Thermo electric and Thermo ionic, MHD generation.
**Nuclear Power Station**: Nuclear fuel – breeding and fertile materials – Nuclear reactor – reactor operation.
**Types of Reactors**: Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding –
Radioactive waste disposal.

**UNIT – V**
**Power Plant Economics**: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, load duration curve.
Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor– related exercises.

**TEXT BOOK :**
1. P.K.Nag, Power Plant Engineering, II Edition, TMH.
2. Arora and S. Domkundwar, A Course in Power Plant Engineering

**REFERENCES :**
1. Rajput , A Text Book of Power Plant Engineering, Laxmi Publications
2. Ramalingam, Power plant Engineering, Scietech Publishers
3. P.C.Sharma , Power Plant Engineering, S.K.Kataria Pub.
4. ElWakil, Power station Engineering, McHill.
5. G.D. Rai, An Introduction to Power Plant Technology
6. Elanchezhian, Power plant Engg, I.K. International Pub.

# *Chhattisgarh Swami Vivekanand Technical University, Bhilai*

Semester: **III M.E (Thermal Engg.)** Branch: **Mechanical Engineering**
**Subject: Cold Preservation of Food** **Code: 564332 (37)**
Total Theory Periods**: 40** Total Tutorial Periods: **12**
Total Marks in End Semester Exam. : **100**
**Minimum number of class test to be conducted:** 02

**Unit – I**
**Introduction**: Necessary of food preservation, general techniques, cold preservation of food.

**Biological Aspects:** Live and dead foods biology of food products such as fruits, vegetables milk meat and fish effect of temperature on food ingredients respiration rates of food products controlled atmospheric storage diseases and deterioration of food.

**Unit – II**
**Cold Preservation of Food:** Short and long term preservation, methods of chilling, freezing and freeze drying, heat and mass transfer analysis of cooling and freezing.

**Unit – III**
**Cold storages**: Site selection building constructional features, load Calculation, equipment, selection safety consideration insurance and management of cold storage of some important food production.

**Unit – IV**
**Food Processing Techniques:** Optimum cold storage Conditions, Standard norms for Processing, Plant Layout, Preservation of Milk, Butter, Fruits, Vegetables, Meat Products etc. Freeze Drying Principles, Techniques and Equipments, Testing of Cold Storage, Code of Practice for fire safety.

**Unit – V**
**Refrigeration Food handling**: Preparation for cooling/freezing, packaging of food, modes of transportation – land. Sea and air, their thermal, load equipment, marketing of refrigerated food.

**Text Books:**

1. Refrigeration Applications to Fish, Fruit and Vegetables in South East Asia, FAO IIR
2. Ibrahim Dincer, Tailor & Francis, Heat Transfer in Food Cooling Applications.
3. ASHRAE HANDBOOK, ASHRAE


**References:**

1. Fennema, Powrie & March, Low Temperature Preservation of Foods and Living Maters, Dekker, 2006
2. Gunther, Refrigeration, Air Conditioning and Cold Storage, Bailey Bros and Swinfen, 1962
3. Tressler, The Freezing and Preservation of Foods, AVT, 1968

# *Chhattisgarh Swami Vivekanand Technical University, Bhilai*

Semester: **III M.E (Thermal Engg.)** Branch: **Mechanical Engineering**
Subject: **Bio-Fluid Mechanics** Code: **564333(37)**
Total Theory Periods**: 40** Total Tutorial Periods: **12**
Total Marks in End Semester Exam. : **100**
**Minimum number of class test to be conducted:** 02

**UNIT I**
Overview of basic anatomy and physiology from fluid flow perspective.
Review of basic equations and constitutive models: mass and momentum conservation, models for non-Newtonian fluids.

**UNIT II**
Blood rheology and mechanics of circulation: composition, structure and flow properties of blood; structure, flow and pressure characteristics of the blood flow in cardio-vascular system, flow of non-Newtonian fluids in elastic tubes.

**UNIT III**
Arterial wave propagation-oscillatory and pulsatile flow, pulse waves, behaviour at bifurcations, wave propagation, fluid mechanics of breathing.

**UNIT IV**
Flow through the pulmonary system: structure and function of pulmonary system, fluid exchange processes, fluid mechanics of breathing.
Flow and lubrication in musculo-skeletal system: hemodynamics of red blood cells, synovial fluid in joints.

**UNIT V**
Flow through the porous media: oxygen diffusion from blood to tissues, flow in ocular and renal system.
Computational biofluid mechanics: computational methods for flow and wave propagation through elastic tubes, flow through porous media.

**Text Books:**

1. Chandran K.B., Yoganathan, A. and Rittgers S, Fluid Mechanics in the Human Circulation, Pearson Education, 2005
2. Humphrey J.D. and Delange S.L., An Introduction to Biomechanics, Springer-Verlag, 2004
3. Fournier R.L.L., Basic Transport Phenomena in Biomedical Engineering, Taylor & Francis, 1998


**References:**

1. Fung Y.C., Biomechanics: Circulation, Springer-Verlag, 1996
2. Mazumdar J.N., Biofluid Mechanics, World Scientific, 1992
3. Pedley T.J., Fluid Mechanics of Large Blood Vessels, Cambridge University Press, 1980
4. Caro C.G, Pedly T.J., Schroter RC, Seed W.A., Mechanics of the Circulation, Cambridge University Press, 1978

# *Chhattisgarh Swami Vivekanand Technical University, Bhilai*

Semester: **III M.E (Thermal Engg.)** Branch: **Mechanical Engineering**
Subject**: Micro & Nano Scale Thermal Engg.** Code: **564334 (37)**
Total Theory Periods**: 40** Total Tutorial Periods: **12**
Total Marks in End Semester Exam. : **100**
Minimum number of class test to be conducted**: 02**

**UNIT I**
Introduction
Microscale energy transport in solids

**UNIT II**
Molecular clusters
Molecular forces and phase change in thin liquid films

**UNIT III**
Heat Transfer in microchannels
Micro heat pipes

**UNIT IV**
Microscale heat transfer in biological systems at low temperature

**UNIT V**
Nanofluids

**Text Books:**


1. Tien CL, Majumdar A and Gerner F.M., Microscale Energy Transport, Taylor & Francis, 2003
2. Berman R, Thermal Conduction in Solids, Oxford Press, 1976


**References:**


1. Tien C.L, Molecular and Microscale Heat Transfer, Begell House, 1994
2. Celate G.P., Heat Transfer and Transport Phenomena in Microscale, Begell House, 2000
3. Kakac S, Vasiliev L.L., Bayazitoglu Y, Yener Y, Microscale Heat Transfer: Fundamentals and Applications, Springer-Verlag, 2005