

# **Chhattisgarh Swami Vivekanand Technical University, Bhilai**

## **Scheme of teaching and examination**

### **B.E. IV Semester Metallurgical Engineering**

S. No.	Board of Study	Subject Code	Subject	Periods per week			Scheme of Exam			Total Marks	Credit L+(T+P)/2
				L	T	P	Theory/ Pract.				
							ESE	CT	TA		
1	Electrical Engg.	338411 (24)	Electrical Technology & Electronics	4	1	-	80	20	20	120	5
2	Appl. Mathematics	338412 (14)	Numerical Analysis	4	-	-	80	20	20	120	4
3	Metallurgical Engg.	338413 (38)	Testing of Materials	3	1	-	80	20	20	120	4
4	Metallurgical Engg.	338414 (38)	Material Science & Metallography	3	1	-	80	20	20	120	4
5	Metallurgical Engg.	338415 (38)	Metallurgical Thermodynamics & Kinetics	3	1	-	80	20	20	120	4
6	Metallurgical Engg.	338416 (38)	Engineering Polymers & Composites	3	1	-	80	20	20	120	4
7	Electrical Engg.	338421 (24)	Electrical Technology & Electronics Lab	-	-	3	40	-	20	60	2
8	Metallurgical Engg.	338422 (38)	Testing of Materials Lab	-	-	3	40	-	20	60	2
9	Metallurgical Engg.	338423 (38)	Material Science & Metallography Lab	-	-	3	40	-	20	60	2
10	Metallurgical Engg.	338424 (38)	Non-Destructive Testing Lab	-	-	3	40	-	20	60	2
11	Humanities etc.	300425 (46)	Health, Hygiene and Yoga	-	-	2	-	-	40	40	1
12			Library	-	-	1	-	-	-	-	-
<b>Total</b>				<b>19</b>	<b>6</b>	<b>15</b>	<b>640</b>	<b>120</b>	<b>240</b>	<b>1000</b>	<b>34</b>

L-Lecture, T-Tutorial,  
P-Practical, ESE- End sem. Exam, CT-Class Test,  
TA- Teacher's Assessment,

**Note:** Industrial Training of twelve weeks is mandatory for the students. It is to be completed in two parts. The first part will be in summer after IV Sem after which students have to submit a training report which will be evaluated by the college teachers during V sem.

# CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY BHILAI (C.G.)

Semester: **B.E. IV**  
Subject: **Electrical Technology & Electronics**  
Total Theory Periods: **50**  
Total Marks in End Semester Exam: **80**  
Minimum number of class test to be conducted: **02**

Branch: Metallurgical Engineering  
Code: **338411 (24)**  
Total Tutorial Periods: **12**

## Unit-1

**D.C. Motors** – Operating principles, classification, characteristics, (Elect & Mechanical) starting method 3 point & 4 point starter, speed control -ward Leonard control braking Application.

## Unit –2

A.C. motors -

- (a) Construction and operating principles of three phase induction motor, equivalent circuit, Torque slip characteristics, Star delta starter.
- (b) Three phase synchronous motor- working principles, starting, application.
- (c) Single phase Induction Motor fractional horse power motors, their applications

## Unit – 3

**Semiconductors and Transistors** – Intrinsic and extrinsic semiconductors, PN junction diodes, zener diode, junction transistors PNP and NPN transistors and their working in CB CE and CC configurations, Half wave and Full wave rectifier circuits using semiconductors, Basic amplifier circuit.

## Unit – 4

**Electric Heating** – Modes of transfer of heat, Classification of electrical heating method. Resistance heating, Infrared heating Arc furnaces Induction heating, High frequency eddy current heating, Dielectric heating, choice of frequency.

## Unit – 5

**Electric welding** – Resistance welding, electric arc welding, ultrasonic welding, electron beam welding, laser beam welding Requirements of good weld. Preparation of work electrodes, Electric welding equipment.

## Text Books:

1. Electrical Technology Vol-I & II B.L. Theraja
2. Basic Electronics – Theraja

## Reference Book

1. Basic electronics – V.K. Mehata (S.Chand & Co.)
2. Basic Electronics – Tata McGraw Hill

# CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY BHILAI (C.G.)

Semester: **B.E. IV Sem.**

Subject: **Numerical Analysis**

Total Theory Periods: **50**

Total Marks in End Semester Examination: **80**

Minimum number of Class tests to be conducted: **Two**

Branch: **Metallurgical Engg.**

Code: **338412 (14)**

Total Tutorial Periods: **Nil**

- Unit –1      Solution of Algebraic and Transcendental equations:**  
Erraors, Bisection, Regular-Falsi, secent, Newton-Raphson methods, Lin-Bairstow's method, Graeffe root squaring method.
- Unit – 2      Solution of simultaneous Algebric equations:**  
Gauss-elimination, Gauss-Jordan's. Cout's triangularisation method, Gauss-seidelileration method.
- Unit –3      Numerical Solution of ordinary Differential Equation:**  
Pricards method, Taylor's series method, Euler's method, modified method, Runge-Kutta method, Predictor-Corrector methods, Miline's method.
- Unit –4      Simultaneous First order Differential Equations:**  
Picards, Runge-Kutta methods, second order differential equation, Boundary value problems, finite difference method.
- Unit –5      Difference Equations:**  
Formation, order, linear difference equations, C.F., P.L., Reducible to linear forms, simultaneous difference equations with constant coefficients.

## **Text Books and Reference:**

1. Numerical methods in Engg. & Science - By B.S. Grewal.
2. Calculus of finite differences and - by Gupta and Malik " Krishna Prakashan"  
Numerical Analysis

# CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY BHILAI (C.G.)

Semester: **B.E. IV**

Subject: **Testing of Materials**

Total Theory Periods: **40**

Total Marks in End Semester Exam: **80**

Minimum number of class test to be conducted: **02**

Branch: **Metallurgical Engineering**

Code: **338413 (38)**

Total Tutorial Periods: **12**

## Unit-1

**Plastic deformation of metals** – Lattice defects, deformation by slip and twinning, critical resolved shear stress for slip, yield point phenomenon, strain hardening

**Failures** – Types and their characteristics, nucleation of cracks and their propagation, theoretical cohesive strength of metals, Griffith theory of brittle failure, dislocation theory of fracture, ductile to brittle transition.

## Unit – 2

**Material Testing** – Importance and application of testing methods, role of specifications and standards for materials.

**Tensile Test** – Flow curve, engineering and true stress – true strain curve, yield stress and proof stress, universal tensile testing machine and tensometer, principle of stress and strain measurement, bend test, measurement of ductility and formability.

## Unit – 3

**Hardness test** – Principles and machines used – Brinell, Vickers, Rockwell, Scleroscope and micro hardness testing.

**Impact Test** – Izod and Charpy Notched bar impact test, Metallurgical factors affecting brittle to ductile transition.

## Unit – 4

**Fatigue and Creep Testing** – Elementary treatment of fatigue phenomenon, S – N curve and corrosion fatigue, fatigue testing principle.

Signification of Creep, testing procedure creep curve and its interpretation, stress-rupture test, Metallurgical and mechanical factors affecting, creep and fatigue failures.

## Unit – 5

**Non-destructive testing** – Importance, scope, advantages and limitations – Dye penetrant, radiographic, magnetic, ultrasonic and electrical methods of testing and their application.

## Text Books

1. Mechanical Metallurgy – George E. Dieter
2. Testing of Metallic Materials – A V K Suryanarayan

## Reference Books

1. Testing and Inspection of Engineering Materials- Davies, Taroxall and Wiscosil
2. Mechanical Testing of Metallic Materials – D A Beument.
3. Engineering Materials Science - C W Richards
4. Non Destructive testing - Bac Gonnagle.

# CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY BHILAI (C.G.)

Semester: **B.E. IV Sem.**

Subject: **Material Science And Metallography**

Total Theory Periods: **40**

Total Marks in End Semester Examination: **80**

Minimum number of Class tests to be conducted: **Two**

Branch: **Metallurgical Engg.**

Code: **338414 (38)**

Total Tutorial Periods: **12**

## **Unit –1 Atomic Arrangement in Materials**

Atomic packing Crystal Systems, Crystal Structures of metals, Packing efficiency, Crystallographic planes and directions, Miller Indices, Crystal Imperfections, point and line defects.

## **Unit – 2 Bonding in Metals**

Wave mechanical model of atoms, Inter atomic forces in atomic aggregates, ionic Band, Covalent Band, Metallic Bond and Vander wall Bond.

## **Unit –3 Steels and Cast irons**

Iron Carbon Diagram, Classification, microstructure and mechanical properties of plain carbon steels, Classification, microstructure and mechanical properties of cast irons.

## **Unit –4 Modern Materials**

Biomaterials, Materials for Aerospace Applications, Military Materials, Smart and Intelligent Materials, Shape Memory Alloys, Rapidly Solidified Materials, Superalloys and magnetic materials, Some important non- ferrous alloys.

## **Unit –5 Microscopic and macroscopic Examination of metals**

Study of Metallurgical Microscope, Cold Mounting and Hot Mounting of Metallic samples, Polishing and Etching techniques, Microstructural features, Interpretation of microstructure and details of microstructures. Corelation between Microstructure of a metal and its mechanical properties.

High Temperature Microscopy: - Necessity, importance and associated details.

## **Books Recommended.**

### **Text Books**

- |    |                            |   |                                   |
|----|----------------------------|---|-----------------------------------|
| 1. | Material Science and Engg. | - | V. Raghavan                       |
| 2. | Material Science           | - | Van Vlack                         |
| 3. | Materials Science          | - | G K Naruola, KS Narula, V K Gupta |

### **Reference Books**

- |    |  |   |                                 |
|----|--|---|---------------------------------|
| 1  | Physical Metallurgy                                  | - | V. Raghvan                      |
| 3. | Engineering Metallurgy                               | - | A.V. Ramarao and R.L. Vyas      |
| 4. | Modern Metallography                                 | - | R.E. Smallman and K.H.G. Ashbee |
| 5. | Metallurgy for Engineers                             | - | E.C. Rollason                   |
| 6. | Metals Handbook                                      | - | ASM Publication                 |
| 7. | Journals of American Society of Metals International |   |                                 |
| 8. | Metal News   | - | Indian Institute of Metals      |

# CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY BHILAI (C.G.)

Semester: **B.E. IV Sem.**

Subject: **Metallurgical Thermodynamics & Kinetics**

Total Theory Periods: **40**

Total Marks in End Semester Examination: **80**

Minimum number of Class tests to be conducted: **Two**

Branch: **Metallurgical Engg.**

Code: **338415 (38)**

Total Tutorial Periods: **12**

## **Unit –1 Basic Concepts**

Brief review of first and second law of thermodynamics and their applications.

Third law of thermodynamic equilibrium statement experimental proof: theory of specific heats.

## **Unit – 2 Criteria of Thermodynamics**

Isothermal and adiabatic processes, combined statement of first and second laws, Gibbs and Helholtz free energy; important thermodynamic relationship including Maxwell's relation and thermodynamic equation of state.

## **Unit –3 Single Component System.**

Thermodynamic function of gases fugacity, thermodynamic function A condensed phases of metallurgical interest equilibria in two phase systems, Vant Hoff and Clausius Clayperon equations; equilibria in three phase systems.

## **Unit –4 Multicomponents System.**

Concept of activity and standard states, Henrij's Low, Roul't's law partial molar properties chemical potential and Gibbs Duhem equation and methods of its integration for binary system, equilibria in systems of metallurgical interest. Ellingham- diagram and phase relation, free energy composition diagrams and their applications in establishing simple phase diagrams.

## **Unit –5 Chemical Kinetics -**

Order and molecularity of reaction; Arrhenuis equation.

## **Books Recommended:**

1. "Introduction to Metallurgical thermodynamics" by D.R. Gaskell.
2. "Physical Chemistry of Metals" by Darken and Gurry".
3. "Metallurgical Thermodynamics by P.R. Khangaonkar ".
4. "Physical Chemistry of Metallurgical Processes" by Biswas and Bashforth."
5. "Metallurgical Thermo chemistry" by Kubaschusky and Evans.

# CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY BHILAI (C.G.)

Semester: **B.E. IV**  
Subject: **Engineering Polymers and Composites**  
Total Theory Periods: **40**  
Total Marks in End Semester Exam: **80**  
Minimum number of class test to be conducted: **02**

Branch: **Metallurgical Engineering**  
Code: **338416 (38)**  
Total Tutorial Periods: **12**

## Unit-1

Definition of polymers, Natural and synthetic polymers, polymerization reaction and its (mechanisms) types, Industrial polymers and their characterization, plastics and their types, properties of plastics like mechanical, thermal and electrical properties and their correlations with polymer structure, polymer crystallinity, elastomers their structure and properties, vulcanization.

## Unit – 2

Thermoplastic commodity and engineering plastics. Fabrication methods for plastics like compression and injection moulding, transfer and extrusion moulding, casting, foamed plastics, fabrication of rubber & calendaring, dispersions, foam rubber, fabrication of special polymer products like polymer composites.

## Unit – 3

Selection of plastic/polymeric materials - Methodology of selection, plastics for mechanical and structural applications, plastics for wear & friction, corrosion and electrical applications, polymer coating.

## Unit – 4

Introduction and classification of composite materials, strengthening mechanisms in composites, matrix and reinforcement options for composites, reinforcing materials: fibers, whiskers and particles.

## Unit – 5

Manufacture of glass fibers, fabrication of fiber-reinforced plastics and metal matrix, properties and application of composites.

## Books Recommended:

### Text Books

1. Materials Science & Manufacturing processes – D.Kumar, S K Jain & A K Bhargava, PHI
2. Engineering Materials-Properties & Selection – Kenneth G Budinshi Michael K Budinshi, PHI

### Reference Books

1. Composite Materials: Engineering & Science – F L Mathews & R D Rawlings (Chapman & Hall, 1994)
2. Composite Materials: Engineering & Science – Vol II, B K Agrawal (Tata McGraw Hill)
3. Polymer Materials – C M Hall (Mac Millan Education Ltd, 1989)

### Reference Books

1. Testing of metallic Materials – Suryanarayan

# CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY BHILAI (C.G.)

Semester: **B.E. IV**  
Subject: **Electrical Technology & Electronics Lab**  
Total Marks in End Semester Exam: **40**

Branch: Metallurgical Engineering  
Code: **338421 (24)**  
Total Practical Periods: **40**

## List of Experiment: -

1. Magnetization Characteristics of a separately excited DC Machine.
2. Speed Control of a DC Shunt Motor.
3. Load Test on a DC shunt/Compound Motor.
4. Load Test on a DC Shunt/Compound Generator.
5. Load Test on 3 phase induction motor.
6. Load test on 1 phase transformer.
7. Study of DC Shunt Motor Starter
8. Study of Star-Delta Starter.
9. To perform no load and blocked rotor test on 3- phase induction motor.
10. To perform open circuit and short circuit test on 3- phase alternator and find per unit reactance and voltage regulation.

## Text Books:

1. Electrical Technology Vol-I & II B.L. Theraja
2. Basic Electronics – Theraja

## Reference Book

1. Basic electronics – V.K. Mehata (S.Chand & Co.)
2. Basic Electronics – Tata McGraw Hill



# CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY BHILAI (C.G.)

Semester: **B.E. IV**  
Subject: **Testing of Materials Lab**  
Total Marks in End Semester Exam: **40**

Branch: **Metallurgical Engineering**  
Code: **338422 (38)**  
Total Practical Periods: **40**

## List of Experiments:

1. Tensile test – Ductile Fracture, Brittle Fracture
2. Hardness test- Brinell hardness, Rockwell hardness, Vicker's diamond Pyramid method, shore or Rebound hardness test.
3. Impact test- Izod, Charpy
4. Compression test
5. Fatigue test
6. Creep test
7. Study of Universal testing machine
8. Spring test to determine the resilience property of spring
9. Cupping test – ductility Determination
10. Strut test- strength of Column

## Text Books

1. Mechanical Metallurgy – George E. Dieter
2. Testing of Metallic Materials – A V K Suryanarayan

## Reference Books

1. Testing and Inspection of Engineering Materials- Davies, Taroxall and Wiscosil
2. Mechanical Testing of Metallic Materials – D A Beument.
3. Engineering Materials Science - C W Richards
4. Non Destructive testing - Bac Gonnagle.

# CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY BHILAI (C.G.)

Semester: **B.E. IV Sem.**  
Subject: **Material Science And Metallography Lab**  
Total Marks in End Semester Examination: **40**

Branch: **Metallurgical Engg.**  
Code: **338423 (38)**  
Total Practical Period : **40**

## List of Experiments:

1. Preparation of sample for the study of microstructure.
2. Sulphur printing
3. Phosphorous printing
4. Study of crystal structure of Metals
5. Hot Mounting of metallic sample
6. Cold Mounting of Metallic sample
7. Study of Iron carbon diagram.
8. Determination of tensile strength of metal using tensometer.
9. Determination of electrical conductivity of a non-ferrous metal
10. Determination of resistance of metal using LCR Bridge
11. Strain determination using strain gauges.

## Books Recommended.

### Text Books

- |    |                            |   |                                   |
|----|----------------------------|---|-----------------------------------|
| 1. | Material Science and Engg. | - | V. Raghavan                       |
| 2. | Material Science           | - | Van Vlack                         |
| 3. | Materials Science          | - | G K Naruola, KS Narula, V K Gupta |

### Reference Books

- |   |  |   |                                 |
|---|--|---|---------------------------------|
| 1 | Physical Metallurgy                                  | - | V. Raghvan                      |
| 2 | Engineering Metallurgy                               | - | A.V. Ramarao and R.L. Vyas      |
| 3 | Modern Metallography                                 | - | R.E. Smallman and K.H.G. Ashbee |
| 4 | Metallurgy for Engineers                             | - | E.C. Rollason                   |
| 5 | Metals Handbook                                      | - | ASM Publication                 |
| 6 | Journals of American Society of Metals International |   |                                 |
| 7 | Metal News   | - | Indian Institute of Metals      |

# CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY BHILAI (C.G.)

Semester: **B.E. IV**  
Subject: **Non- Destructive Testing Lab**  
Total Marks in End Semester Exam: **40**

Branch: Metallurgical Engineering  
Code: **338424 (28)**  
Total Practical Periods: **40**

## List of Experiments :

1. Dye Penetration Test
2. Radiographic Test
3. Magnetic Test (Magna flux)
4. Ultrasonic Test
5. Electrical Methods
6. Spark Test

## Reference Books

Testing of metallic Materials – Suryanarayan

# CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

Semester : IV Sem.

Branch: Common for all branches

Subject : **HEALTH, HYGIENE & YOGA**

Code : 300425 (46)

Minimum number of class tests to be conducted: Two

Teacher's Assessment: 40 Marks

## UNIT- I

**HEALTH & HYGIENE:** Concept of health, Physical health and mental health and wellbeing and how to achieve these, longevity and how to achieve it, concept and common rules of hygiene, cleanliness and its relation with hygiene; Overeating and undereating, amount of food intake required, intermittent fasting; adequate physical labour, sleep; consumption of junk fast food vs nutritious food; fruits, vegetables cereals and qualities of each of these.

## UNIT- II

INTRODUCTORY KNOWLEDGE OF COMMON STREAMS OF MEDICINAL CURE: **History, development, basic concepts, modes of operation of Allopathy, Ayurved, Homoeopathy, Biochemic, Unani, Siddha, Accupressure, Accupunture, Naturopathy, Yogic and Herbal system of medicines, Introduction of Anatomy and Physiology concerned.**

## UNIT- III

**YOGASANS:** Meaning and concept of Yoga, Yogasans and its mode of operation, How to perform Yogasans, Common Yogasans with their benefits, such as, Padahastasan, Sarvangasan, Dhanurasan, Chakrasan, Bhujangasan, Paschimottasan, Gomukhasan, Mayurasan, Matsyasan, Matsyendrasan, Pawanmuktasan, Vajrasan, Shalabhasan, Sinhasan, Shashankasan, Surya Namaskar, Halasan, Janushirasan, Utshep Mudra,

## UNIT- IV

**YOGASANS FOR COMMON DISEASES:** From Yogic Materia Medica with symptoms, causes, asans and herbal treatment.

✍✍**Modern silent killers:** High blood pressure, diabetes and cancer, causes and cure; Common health problems due to stomach disorders, such as, indigestion, acidity, dysentery, piles and fissures, arthritis, its causes, prevention and cure.

✍✍**Asans for relaxation:** Shavasana, Makarasana, Matsyakridasana, Shashankasana.

✍✍**Asans to increase memory and blood supply to brain :** Shirsh padasana, Shashankasana.

✍✍**Asans for eye sight:** Tratak, Neti Kriya .

✍✍**Pranayam :** Definition and types : Nadi Shodhan, Bhastrik, Shitakari, Bhramari useful for students.

## UNIT V

**CONCENTRATION:** Concentration of mind and how to achieve it. Tratak /=kVd/ Concentration on breath, Japa /ti/ Ajapajap /vtikti/ internal silence /v/lekk/ visualization in mental sky /pndk'k /kj.kk/ Concentration on point of light /T; kfr /; ku/ Concentration on feeling /kkko /; ku/ Concentration on figure /e/kl /; ku/

## REFERENCES

(1) Yogic Materia Medica

(2) Asan, Pranayam and Bandh

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