

JHARKHAND RAI UNIVERSITY



MINING ENGINEERING

B.Tech



SYLLABUS (2020-2024) SEMESTER I

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B.TECH SEMESTER I

COURSE SCHEME												
BATCH 2020-2024												
BTECH IN MINING ENGINEERING												
SEMESTER I												
S. No	CATEGORY	CODE	COURSE TITLE	Periods			Evaluation Scheme				Subject Total	Credit
				L	T	P	Assignment	TA	Total	ESE		
1	Basic Science Course	BSC101	Physics I	3	1	0	20	10	30	70	100	4
2	Basic Science Course	BSC102	Mathematics I	3	1	0	20	10	30	70	100	4
3	Engineering Science Course	ESC101	Basic Electrical Engineering	3	1	0	20	10	30	70	100	4
4	Engineering Science Course	ESC102	Engineering Graphics & Design	1	0	0	20	10	30	70	100	1
5	Humanities and Social Sciences	HSMC101	English	2	0	2	20	10	30	70	100	3
PRACTICAL /SESSIONAL												
1	Basic Science Course	BSC101P	Physics I Lab	0	0	3			30	20	50	1.5
2	Engineering Science Course	ESC101P	Basic Electrical Engineering Lab	0	0	2			30	20	50	1
3	Engineering Science Course	ESC102P	Engineering Graphics & Design Lab	0	0	4			30	20	50	2
										TOTAL	650	20.5

Program: B.Tech
Semester: First
Course: Physics I
Course Code: BSC101

L	T	P	C
3	1	0	4

Course Objective:

The objective of this course is

- To understand the students with the concepts of Electromagnetic Theory and applications of Electromagnetic Theory.
- To understand the theory of Quantum Mechanics.
- To apply the theory of Mechanics.
- To illustrate the different Phenomena of Wave Optics.
- To explain Laser, types of Laser and applications of Laser.
- To understand the concept of Semiconductor Physics and Semiconductor devices.

Course Outcome:

After the completion of the course, student will be able to:

- **CO1:** Apply the basic concepts of electromagnetic theory.
- **CO2:** Explain the dual nature of matter and wave equation.
- **CO3:** Demonstrate the types of motion and different types of forces.
- **CO4:** Describes the different Phenomena of Wave Optics, principles of lasers, types of lasers and their application.
- **CO5:** Design the different types of diodes.

Module 1: Introduction to Electromagnetic Theory (10)

Laplace's and Poisson's equations for electrostatic potential and. Boundary conditions of electric field and electrostatic Potential. Energy of a charge distribution and its expression in terms of electric field. Solving simple electrostatics problems in presence of dielectrics – Point charge at the centre of a dielectric sphere, Bio-Savart law, Divergence and curl of static magnetic field; Magnetization magnetic susceptibility and ferromagnetic, paramagnetic and diamagnetic materials. Faraday's law in terms of EMF produced by changing magnetic flux, Lenz's law. Differential form of Faraday's law Displacement current and Maxwell's equations.

Module II: Quantum Mechanics (7)

Introduction to Quantum mechanics, Wave nature of Particles, Time-dependent and time independent Schrodinger equation for wave function, Uncertainty principle. Solution of stationary-state Schrodinger equation for one dimensional problems– particle in a box, particle in three dimensional box.

Module III: Introduction to Mechanics (8)

Scalars and vectors Forces in Nature; Newton's laws and its completeness in describing particle motion; Form invariance of Newton's Second Law; Solving Newton's equations of motion in polar coordinates; $F = -\text{Grad } V$; Definition and motion of a rigid body in the plane; Rotation in

the plane; Kinematics in a coordinate system rotating and translating in the plane; Angular momentum about a point of a rigid body in planar motion; Euler's laws of motion, their independence from Newton's laws, and their necessity in describing rigid body motion; Examples.

Module IV: Oscillation, Waves and Optics (8)

Mechanical and electrical simple harmonic oscillators. Brewster's Law, total internal reflection, Mirrors & lenses and optical instruments based on them. Amplification of light by population inversion, different types of lasers: gas lasers (He-Ne), solid-state lasers (ruby Laser). Properties of laser beams, applications of lasers in science, engineering and medicine.

Module V: Semiconductor Physics (7)

P-N junction, Metal-semiconductor junction (Ohmic and Schottky); Carrier transport, generation, and recombination; Semiconductor materials of interest for optoelectronic devices. Rates of optical transitions LED: device structure, materials, characteristics, and figures of merit. Types of semiconductor photo detectors -p-n junction, PIN, and Avalanche.

Suggested Reading:

1. *Engineering Physics : R.K.Gaur & S.L. Gupta*
2. *Engineering Physics : G.S. Raghuvanshi*
3. *Modern Engineering Physics: A.S.Vasudeva*
4. *David Griffiths, Introduction to Electrodynamics*
5. *Halliday and Resnick, Physics*
6. *D. J. Griffiths, Quantum*
7. *Engineering Mechanics, 2nd ed. — MK Harbola*
8. *D. J. Griffiths, "Quantum mechanics", Pearson Education.*
9. *S. M. Sze, Semiconductor Devices: Physics and Technology.*

Program: B.Tech

Semester: First

Course: Physics I

Course Code: BSC101P

L	T	P	C
0	0	3	1.5

List of Laboratory Experiments/Demonstrations:

1. Find the acceleration due to gravity using Kater's pendulum.
2. Find the resistance of a given wire using Meter Bridge.
3. To establish the current voltage relationship for a metallic conductor and find its resistance.
4. To determine the unknown resistance of given wire using Potentiometer.
5. Find the acceleration due to gravity using Simple pendulum.
6. To determine Young's modulus of the material of a given wire using Searle's Apparatus
7. To determine the unknown resistance of given wire using Potentiometer.
8. To determine the wavelength of sodium light by Newton's ring method.
9. To measure the wavelength of Mercury spectrum using Spectrometer grating.
10. To study the variation of magnetic field with distances using Helmholtz Galvanometer.

Program: B.Tech
Semester: First
Course: Mathematics I
Course Code: BSC102

L	T	P	C
3	1	0	4

Course Objective:

To familiarize the student with:

- The mathematical tools needed in evaluating multiple integrals and their usage. .
- The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
- The tool of Multivariate Calculus for learning advanced Engineering Mathematics.
- To deal with functions of multiple integration that are essential in most branches of engineering.
- The essential tool of sequences and series in a comprehensive manner.

Course Outcome:

After the completion of the course, student will be able to:

- CO 1: Able to calculate rank of matrix, characteristic equation & characteristic roots & use the applicability of Cayley Hamilton Theorem to find inverse of matrix which is very important in many engineering application
- CO 2: Ability to understand calculus and its application in engineering
- CO 3: Gain knowledge about multiple differentiation which is helpful in Engineering & it is also useful in Research & Development
- CO 4: Gain knowledge about multiple Integration which is helpful in Engineering & it is also useful in Research & Development
- CO 5: Appreciate knowledge of sequences and series and its application in real world problems.

Module 1: Matrices:

6 Hours

System of linear equations; rank of a matrix, rank-nullity theorem; Symmetric, skew symmetric and orthogonal matrices; Eigen values and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation; Cramers rule.

Module 2: Calculus:

6 Hours

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L'Hospital's rule, Evaluation of definite and improper integrals; Beta and Gamma functions and their properties.

Module 3: Multivariable Calculus (Differentiation):

6 Hours

Partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points, Method of Lagrange multipliers.

Module 4: Multivariable Calculus (Integration):

8 Hours

Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes and sphere.

Module 5: Sequences and series:

6 Hours

Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and Logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

Suggested Reading:

1. H.K. Dass, "Advance Engineering Mathematics"; S.Chand &Co., 9th Revised Ed., 2001.
2. B.S. Grewal, "Higher Engineering Mathematics".
3. E. Kreyszig, "Advance Engineering

Program: B.Tech

Semester: First

Course: Basic Electrical Engineering

Course Code: ESC101

L	T	P	C
3	1	0	4

Course Objective:

- To understand and analyze basic Electric and Magnetic circuits.
- To study the working principles of Electrical Machines and Power Converters.
- To introduce components of Low Voltage Electrical Installations

Course Outcome:

After the completion of the course, student will be able to:

CO1: Demonstrate and apply basics of electrical engineering networks their applications with different input conditions and analysis.

CO2: Apply fundamentals of electromagnetism and basic design concept of single-phase transformer and measurement of losses.

CO3: Realize the concept and working of different types of DC and AC machines and will be able to select right machine to meet desired needs for implementing engineering solutions.

CO4: Understand the basic circuits of converters, inverters, Switchgear and earthing & types of battery.

Unit 1: D.C. Circuits (8 lectures)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems.

Time-domain analysis of first-order RL and RC circuits.

Unit2: A.C. Circuits (8 lectures)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance.

Three-phase balanced circuits, voltage and current relations in star and delta connections.

Unit3: Transformers (6 lectures)

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency.

Auto-transformer and three-phase transformer connections.

Unit4: Electrical Machines (8 lectures)

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor.

Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Unit 5: Power Converters (6 lectures)

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Unit 6: Electrical Installations (6 lectures)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Suggested Reading:

1. *Basic Electrical Engineering - D.P. Kothari and I.J. Nagrath, 3rd edition 2010, Tata McGraw Hill.*
2. *Basic Electrical Engineering - D.C. Kulshreshtha, 2009, Tata McGraw Hill.*
3. *Fundamentals of Electrical Engineering, L.S. Bobrow, Oxford University Press, 2011*
4. *Electrical and Electronics Technology, E. Hughes, 10th Edition, Pearson, 2010*
5. *Electrical Engineering Fundamentals, Vincent Deltoro, Second Edition, Prentice Hall India, 1989*

Program: B.Tech

Semester: First

Course: Basic Electrical Engineering Lab

Course Code: ESC101P

L	T	P	C
0	0	2	1

List of Laboratory Experiments/Demonstrations:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
3. Transformers: Observation of the no-load current waveform on an oscilloscope (non-sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
4. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
5. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winding - slip ring arrangement) and single-phase induction machine.
6. Torque Speed Characteristic of separately excited dc motor.
7. Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super-synchronous speed.
8. Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.
9. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

Program: B.Tech

Semester: First

Course: Engineering Graphics & Design

Course Code: ESC102

L	T	P	C
1	0	0	1

Course Objective:

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modeling
- Exposure to computer-aided geometric design
- Exposure to creating working drawings
- Exposure to engineering communication

Course Outcome:

After the completion of the course, student will be able to:

- CO 1: To know and understand the conventions and the method of engineering drawing.
- CO 2: To know the Orthographic & Isometrics projections.
- CO 3: To know the various projections of regular solids, Sections and Sectional Views of Right Angular Solids.
- CO 4: To improve visualization skills so that student can apply these skill in developing new products.
- CO 5: To know about graphical communication and various graphical drawing tools.
- CO 6: To know the creation of engineering models and their presentation in standard 2D & 3D forms.

Traditional Engineering Graphics: Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Computer Graphics: Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM)

Module 1: Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

Module 2: Orthographic Projections covering, Principles of Orthographic Projections- Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

Module 3: Projections of Regular Solids covering, those inclined to both the Planes-Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

Module 4: Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

Module 5: Isometric Projections covering, Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

Module 6: Overview of Computer Graphics covering, listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];

Module 7: Customisation & CAD Drawing consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

Module 8: Annotations, layering & other functions covering applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

Module 9: Demonstration of a simple team design project that illustrates Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing

sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

Suggested Reading:

1. *Engineering Drawing textbook Intro By : N D Bhatt*
2. *Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House*
3. *Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education*
4. *Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication*
5. *Narayana, K.L. & P Kannaiyah (2008), Text book on Engineering Drawing, Scitech Publishers*
6. *(Corresponding set of) CAD Software Theory and User Manuals By: R K Dhavan*
7. *Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House*
8. *Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education*
9. *Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication*
10. *Narayana, K.L. & P Kannaiyah (2008), Text book on Engineering Drawing, Scitech Publishers*
11. *Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education*
12. *Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication*

Program: B.Tech

Semester: First

Course: Engineering Graphics & Design Lab

Course Code: ESC102P

L	T	P	C
0	0	4	2

Laboratory Experiments/Demonstrations is to be conducted as per module content.

Program: B.Tech

Semester: First

Course: English

Course Code: HSMC101

L	T	P	C
2	0	2	3

Course Objective:

The objectives of the course are:

- To enhance Professional competence in reading, writing, listening and speaking.
- Switch the approach from providing information about the language to use the language.
- To use English effectively for study purpose across the curriculum;
- To revise and reinforce structure already learnt.
- Introduce Communicative Method of ELT and focusing the teaching pedagogy on the student-centered learning rather than on the teacher-centered learning.
- Ability to master three major forms of communications which are vital in academic and professional settings namely professional presentations, interviews and group communications respectively.
- Providing a deep insight into the techniques for delivering effective presentations, winning job interviews, and actively participating in various forms of group communication.

Course Outcome:

After the completion of the course, student will be able to:

- CO 1: To design a language component or process to meet desired need within realistic, constraints.
- CO 2: To analyze the usage of English words in different contexts.
- CO 3: Develop an understanding of technical and academic articles' comprehension.
- CO 4: To present oneself at multinational levels knowing the type of different standards of English
- CO 5: Students will be made to evaluate the correct and error- free writing by being well viewed in rules of and cultivate relevant style of communication & presentation at their work place and also for academic.
- CO 6: Students will apply it for practical and oral presentation with its presentation skills and voice dynamics.

Detailed contents

1. Vocabulary Building

1.1 The concept of Word Formation

1.2 Root words from foreign languages and their use in English

1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.

1.4 Synonyms, antonyms, and standard abbreviations.

2. Basic Writing Skills

- 2.1 Sentence Structures
- 2.2 Use of phrases and clauses in sentences
- 2.3 Importance of proper punctuation
- 2.4 Creating coherence
- 2.5 Organizing principles of paragraphs in documents
- 2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing

- 3.1 Subject-verb agreement
- 3.2 Noun-pronoun agreement
- 3.3 Misplaced modifiers
- 3.4 Articles
- 3.5 Prepositions
- 3.6 Redundancies
- 3.7 Clichés

4. Nature and Style of sensible Writing

- 4.1 Describing
- 4.2 Defining
- 4.3 Classifying
- 4.4 Providing examples or evidence
- 4.5 Writing introduction and conclusion

5. Writing Practices

- 5.1 Comprehension
- 5.2 Précis Writing
- 5.3 Essay Writing

6. Oral Communication

(This unit involves interactive practice sessions in Language Lab)

- 6.1 Listening Comprehension
- 6.2 Pronunciation, Intonation, Stress and Rhythm
- 6.3 Common Everyday Situations: Conversations and Dialogues
- 6.4 Communication at Workplace
- 6.5 Interviews
- 6.6 Formal Presentations

Suggested Readings:

1. *Practical English Usage*. Michael Swan. OUP. 1995.
2. *Remedial English Grammar*. F.T. Wood. Macmillan. 2007
3. *On Writing Well*. William Zinsser. Harper Resource Book. 2001
4. *Study Writing*. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
5. *Communication Skills*. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. *Exercises in Spoken English. Parts. I-III*. CIEFL, Hyderabad. Oxford University Press