

JHARKHAND RAI UNIVERSITY



MINING ENGINEERING

B.Tech



SYLLABUS

(2020 - 2024)

SEMESTER IV

Kamre | Ratu Road | Ranchi | Jharkhand

Web : www.jru.edu.in | Email : info@jru.edu.in

B.TECH SEMESTER IV

BATCH 2020-2024												
BTECH IN MINING ENGINEERING												
SEMESTER IV												
S.No.	CATEGORY	CODE	COURSE TITLE	Period			Evaluation Scheme				Subject Total	Credit
				L	T	P	Assignment	TA	Total	ESC		
1	Engineering Science Courses	8ESC202	Mechanical Engineering	3	0	0	20	10	30	70	100	3
2	Professional Core Courses	8PCCMiE204	Drilling & Blasting	3	0	0	20	10	30	70	100	3
3	Professional Core Courses	8PCCMiE205	Geology for Mining Engineers	3	0	2	20	10	30	70	100	3
4	Professional Core Courses	8PCCMiE206	Mine Development	3	0	0	20	10	30	70	100	3
5	Professional Core Courses	8PCCMiE207	Mine Surveying II	3	0	2	20	10	30	70	100	3
6	Humanities and Social Sciences	HSMC202	Professional Practices, Laws & Ethics	3	0	0	20	10	30	70	100	3
7	Mandatory Courses	MC201	**Disaster Management	3	0	0	20	10	30	70	100	0
PRACTICAL/ SESSIONAL												
1	Professional Core Courses	8PCCMiE205P	Geology for Mining Engineers Lab	0	0	2			30	20	50	1
2	Professional Core Courses	8PCCMiE207P	Mine Surveying II Lab	0	0	2			30	20	50	1
									TOTAL	800	20	

Vocational Training in a Surface / Underground Mine of minimum 30 (Thirty) days to be taken at the end of IVth Semester Will be Credited in Vth Semester.

**** NOTE: Qualifying Non Credit Course**

Program: B.Tech
Semester: Four
Course: Mechanical Engineering
Course Code: 8ESC202

L	T	P	C
3	0	0	3

Course Objective:

- Ability to apply mathematics, science, and engineering
- Ability to design and conduct experiments, as well as to analyze and interpret data
- Ability to identify, formulate, and solve engineering problems
- Ability to apply modern engineering tools, techniques and resources to solve complex mechanical engineering activities with an understanding of the limitations.
- Ability to comprehend the thermodynamics and their corresponding processes that influence the behavior and response of structural components

Course Outcome:

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

- CO 1: Understand the basic thermodynamics systems & concept of temperature and heat.
- CO 2: To identify and formulate power production based on the fundamentals laws of thermal engineering.
- CO 3: Understand the various cycles and its implications in real practical applications.
- CO 4: Understand the thermodynamics concepts of pure substances & properties of steam.
- CO 5: To appreciate concepts learnt in fundamentals laws of thermodynamics from which learning ideas how to sustain in energy crisis and think beyond curriculum in the field of alternative and renewable sources of energy. To communicate effectively the concepts of internal combustion engines and try to think beyond curriculum in alternative sources of energy.
- CO 6: Understand the concept of ideal & real gases & concept of gas mixtures & its practical applications in engineering.
- CO 7: Understand the Psychrometry and psychrometric charts, property calculations of air vapour mixtures & Psychrometric process..

Module 1:

Basic Concepts- Basic concepts - concept of continuum, macroscopic approach, Thermodynamic systems - closed, open and isolated. Property, state, path and process, quasistatic process, work, modes of work. Zeroth law of thermodynamics, concept of temperature and heat. Concept of ideal and real gases.

Module 2:

First Law of Thermodynamics- Concepts of Internal Energy, Specific HeatCapacities, Enthalpy. Energy Balance for Closed and Open Systems, Energy Balance for Steady-Flow Systems. Steady-Flow Engineering Devices. Energy Balance for Unsteady-Flow.

Module 3:

Second Law of Thermodynamics- Thermal energy reservoirs, heat engines energyconversion, Kelvin's and Clausius statements of second law, the Carnot cycle, the Carnot Theorem, the thermodynamic temperature scale, the Carnot heat engine, efficiency, the Carnot refrigerator and heat pump, COP. Clausius inequality, concept of entropy, principle of increase of entropy –

availability, the increase of entropy principle, perpetual-motion machines, reversible and irreversible processes, Entropy change of pure substances, isentropic processes, property diagrams involving entropy, entropy change of liquids and solids, the entropy change of ideal gases, reversible steady-flow work, minimizing the compressor work, isentropic efficiencies of steady-flow devices, and entropy balance. Energy a measure of work potential, including work potential of energy, reversible work and irreversibility, second-law efficiency, exergy change of a system, energy transfer by heat, work, and mass, the decrease of exergy principle and exergy destruction, energy balance: closed systems and control volumes energy balance.

Module 4:

Properties Of Pure Substance- Properties of pure substances. Thermodynamic properties of pure substances in solid, liquid and vapour phases. Phase rule, P-V, P-T, T-V, T-S, H-S diagrams, PVT surfaces. Thermodynamic properties of steam. Calculations of work done and heat transfer in non-flow and flow processes.

Module 5:

Power Cycles- Vapour and combined power cycles, including the Carnot vapor cycle, Rankine cycle: the ideal cycle for vapor power, the ideal reheat and regenerative and the second-law analysis of vapour power cycles. Gas power cycles, including basic considerations in the analysis of power cycles, the Carnot cycle and its value in engineering, an overview of reciprocating engines, air standard assumptions, gasoline engine Otto cycle, diesel engine cycle, gas-turbine Brayton cycle, and the second-law analysis of gas power cycles.

Module 6:

Ideal and Real Gases and Thermodynamic Relations- Gas mixtures – properties ideal and real gases. Equation of state, Avogadro's Law, Vander Waal's equation of state, Compressibility factor, compressibility chart. Dalton's law of partial pressure. Exact differentials, T-D relations, Maxwell's relations. Clausius Clapeyron equations, Joule – Thomson coefficient.

Module 7:

Psychrometry and psychrometric charts, property calculations of air vapour mixtures. Psychrometric process – Sensible heat exchange processes. Latent heat exchange processes. Adiabatic mixing, evaporative cooling. Use of standard thermodynamic tables, Mollier diagram, Psychrometric chart and Refrigerant property tables. Refrigeration cycles, including refrigerators and heat pumps, the ideal reversed Carnot vapour-compression refrigeration cycle, actual vapor-compression refrigeration cycles, heat pump systems, gas refrigeration cycles, and absorption refrigeration systems.

Suggested Reading:

1. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi.
2. Cengel, Thermodynamics – An Engineering Approach Tata McGraw Hill, New Delhi.
3. Sonntag, R. E., Borgnakke, C., & Wylen, G. J. V. Fundamentals of thermodynamics: Wiley.
4. Moran, M. J., Shapiro, H. N., Boettner, D. D., & Bailey, M. Fundamentals of
5. Jones, J. B., & Dugan, R. E. Engineering thermodynamics: Prentice Hall.

Program: B.Tech
Semester: Four
Course: Drilling and Blasting
Course Code: 8PCCMiE204

L	T	P	C
3	0	0	3

Course Objective:

The objective of this course is to help the students

- To develop knowledge on drilling and blasting operations in underground and surface mines.
- To design blasting pattern for mines and blast design in surface and underground mines.
- To develop knowledge about exploration techniques, drilling operations, casing, various explosives used in opencast & underground.

Course Outcome:

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

- **CO 1:** Understand the exploration techniques, drilling operations, casing, coring and data interpretation.
- **CO 2:** Analyze the appropriate application of explosive in opencast & underground mines.
- **CO 3:** Explain blasting engineering for understanding, formulating and solving blast hole design problems in surface mining.
- **CO 4:** Design various drilling & blasting techniques and their applicability in underground mines.

Module 1

(8 Hours)

Exploratory Drilling : Drilling for exploration; Various types of exploratory drills and their applicability- Auger, Cable-tool, Odex, Core Drills; Core recovery; single and double tube core barrels, wire line core barrel; Storage of cores; Interpretation of borehole data.

Module 2

(8 Hours)

Explosives and Initiation systems : Types of explosives, their composition and properties, classification; Selection of explosives; Manufacture, transport, storage and handling of explosive; Testing of explosives; Types of initiating systems- Electrical Detonators, Detonator fuse, Detonator Relays, NONEL, Electronic Detonators, Blasting accessories, exploders.

Module 3

(10 Hours)

Drilling & Surface Mines: Drilling, Blast hole drills –types, classification, applicability and limitations; Mechanics of drilling, performance parameters, drilling cost, compressed air requirement for hole cleaning; Selection of drilling systems, drilling errors, organization of drilling. Blasting: Mechanics of rock fragmentation; Living stone theory of crater formation; Factors affecting blasting, Blast design –estimation of burden and spacing, estimation of charge requirement; Initiation patterns; Secondary blasting – pop and plaster shooting; Problems associated with blasting, Ground vibration and air over pressure, Blast instrumentation.

Module 4

(10 Hours)

Drilling & Blasting in Underground Mines: Coalmines: Drilling systems and their applicability, blasting-off-solid, different blasting cuts, ring hole blasting, calculation of specific charge, specific drilling and detonator factor, initiation patterns. Metal mines: Drilling systems and their applicability, blast design for horizontal drivages, different blasting cuts, long hole blasting, and vertical crater retreat blasting.

Suggested Reading:

1. *Explosive and Blasting Techniques, G.K. Pradhan*
2. *Explosives and Blasting Techniques, S.K. Das*
3. *Elements of Mining Technology Vol 1 , D J Deshmukh*
4. *Underground Practices, R D Singh*

Program: B.Tech
Semester: Four
Course: Geology for Mining Engineers
Course Code: 8PCCMiE205

L	T	P	C
3	0	0	3

Course Objective:

The objective of this course is to help the students

- To develop knowledge on economics of ore, exploration and practical site investigation.
- To create knowledge about geology of rock, geological disturbances and identification of geological structures in the field.
- To know the coal geology and complete geology of petroleum from origin to extraction.

Course Outcome:

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

- **CO 1:** Discuss the structural geology in aspects of engineering requirements & structural disturbances.
- **CO 2:** Apply the knowledge gained in the contexts of exploration and mineral distribution and able to design the stages of exploration of economic minerals.
- **CO 3:** Discuss the geology of coal along with its classification and origin of coal.
- **CO 4:** Describe the concept on petroleum geology with its migration, accumulation & important basins of India.

Module I

(10 Hours)

Structural Geology: Study of topographical maps; Altitude of planar and linear structures; Effects of topography on outcrops. Unconformities, folds, faults and joints - their nomenclature, classification and recognition. Forms of igneous intrusions - dyke, sill and Batholith. Effects of folds and fractures on strata/ore bodies and their importance in mining operations. Principles of stereographic projections of linear and planar features of rocks.

Module 2

(10 Hours)

Economic Geology and Exploration Geology: Introduction and scope of economic geology; Ore and gangue; Processes of ore formation; Major Indian mineral deposits (Iron, Manganese, Copper, Lead, Zinc) - distribution and mode of occurrence. Mineral Exploration – concepts and methods viz. surface and subsurface; Exploration strategy and design; Stages of exploration; Resources and reserves.

Module 3

(8 Hours)

Coal Geology : Rank, characteristics and important constituents of coal; Classification and origin of coal; Chief characteristics of Indian coals; Geology of the principal coalfields of India.

Module 4

(8 Hours)

Petroleum Geology : Concept of organic constituents of petroleum origin, migration, accumulation, concept of traps and important petroliferous basins of India.

Suggested Reading:

1. *A text book of Geology, P.K. Mukherjee*
2. *Physical Geology, A.K. Dutta*

Program: B.Tech

Semester: Four

Course: Geology for Mining Engineers Lab

Course Code: 8PCCMiE204P

L	T	P	C
0	0	2	1

Course Objective:

1. Study of topographic maps.
2. Completion of outcrops: 1– point and 3–point problems; Map illustrating ‘V’ rules.
3. Calculation of attitude, thickness and depth of ore bodies.
4. Fracture patterns in rose diagram.
5. Maps illustrating fold, fault and unconformity.
6. Stereographic projection.

Program: B.Tech
Semester: Four
Course: Mine Development
Course Code: 8PCCMiE206

L	T	P	C
3	0	0	3

Course Objective:

The objective of this course is to help the students

- To develop basic insight to access of deposit methods & shaft sinking along with drifting and tunneling technology.
- To incorporate the understanding of methods of driving underground openings & headings.
- To appraise the special mining techniques and problems related to sinking & tunneling.

Course Outcome:

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

- **CO 1:** Understand the various methods of development, opening with their shape & locations of coal and metal mining.
- **CO 2:** Explain the various methods, equipments and operations of shaft sinking
- **CO 3:** Gain the knowledge of drivage of horizontal openings in underground and tunneling.
- **CO 4:** Learn about the recent developments in shaft sinking & surface plants in underground mines.

Module 1

(12 Hours)

Opening-up of Deposits: Choice of mode of entry, shaft, decline and combined mode, their applicability, number and disposition. Vertical and Inclined Shafts: Location, shape, size, and organization of shaft sinking, construction of shaft collar, shaft fittings. Shaft Sinking Operations: Ground breaking and muck disposal, tools and equipment, lining; ventilation, lighting and watering; sinking in difficult and water-bearing ground.

Module 2

(8 Hours)

Insets: Design, excavation and lining. Mechanized Sinking: Simultaneous sinking and lining; slip-form method of lining; high speed sinking, Shaft Boring: Methods and equipment.

Module 3

(10 Hours)

Special Attributes: Widening and deepening of inclined and vertical shafts; staple shafts, raised shafts. Main Haulage Drifts and Tunnels: Purpose, shape, size and location; excavation ground breaking, muck disposal, ventilation and supporting. High Speed Drifting/Tunneling: Application of mechanized methods; road headers and tunnel boring machines.

Module 4

(6 Hours)

Recent developments in shaft sinking and drifting/tunneling. Layouts of pit-top and pit-bottom, Coal Handling Plant, Bunkers and Railway Sidings.

Suggested Reading:

1. *Explosive and Blasting Techniques*, G.K. Pradhan
2. *Explosives and Blasting Techniques*, S.K. Das
3. *Introductory mining engg* by H.L.Hartman

Program: B.Tech
Semester: Four
Course: Mine Surveying II
Course Code: 8PCCMiE207

L	T	P	C
3	0	0	3

Course Objective:

The objective of this course is to help the students

- To understand & carry out underground surveys and stope measuring.
- To develop plotting contour plans
- Understand advanced surveying techniques such as remote sensing and geodetic surveying.
- The students will have practical knowledge about recent development of surveying and mine planning.
- Students are made aware about the modern survey equipment and methods for precision survey.
- The students will have practical knowledge about survey instruments and its workings.

Course Outcome:

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

- **CO 1:** Illustrate & apply various survey instruments like Total Station, Theodolite, EDM used in general and mine survey, through practical and demonstrations.
- **CO 2:** Apply knowledge of surveying for understanding, formulating and solving correlation surveying problems & slope surveying.
- **CO 3:** Demonstrate GPS used in general mine survey in opencast mine.
- **CO 4:** Analyze the application of IT in surveying & GIS.

Module 1

(10 Hours)

Control Surveys: Triangulation–classification; Reconnaissance; Procedures for angles and Base-Line measurement; Comparison with precise EDM traversing. Direction Measurement by Astronomical observation: Definition of astronomical terms; Time systems; Determination of true bearing of a survey line by astronomical observations. Gyro-North Determination: Principle of Gyro-theodolite/ Gyromat; Determination of Gyro-north.

Module 2

(12 Hours)

Correlation: Methods of correlation–direct traversing in inclined shaft, correlation in vertical shaft–single and two shafts, Gyro-Laser combination; Shaft depth measurement. Development Surveys: Control of direction and gradient in drifts, tunnels, raises, winzes. Slope Surveying: Purpose; Methods of survey in moderately and steeply inclined ore bodies, flat and vertical ore bodies/seams.

Module 3

(8 Hours)

Slope Monitoring in Opencast Mines: Geodetic and Remote Sensing Methods, Slope Stability Radars GPS: Principle of GPS; Instrument; Errors and working with GPS; Application of GPS in mine surveying; Developments in satellite based Navigation system.

Module 4

(6 Hours)

Application of Automation & IT in surveying: Data acquisitions; Preparation of plans and sections; Calculation of earth works. Introduction to surveying software's. Application of GIS and Remote Sensing in Surveying.

Suggested Reading:

1. *Surveying and leveling*, T. P. Kanetkar
2. *Surveying & Levelling*, B.C. Punmia

Program: B.Tech

Semester: Four

Course: Mine Surveying II Lab

Course Code: 8PCCMiE207P

L	T	P	C
0	0	2	1

List of Experiments:

1. Precise Levelling and distribution of closing error.
2. Study and sketch of Digital Level.
3. Detailed surveying and contouring with Total Station.
4. Working with SURPAC and preparation of Mine Plan.
5. Earthwork calculation using SURPAC and plotting.
6. Plotting of sections using LISCAD.
7. Study and practice of Gyro-theodolite/Gyromat.
8. Study of GPS and data collection; GPS data downloading and post- processing.
9. Study of Nadir Plummet and LASER for Correlation survey.
10. Subsidence monitoring using 1" – Micro-optic Theodolite & Precise Level.

Program: B.Tech

Semester: Four

Course: Disaster Management

Course Code: MC201

L	T	P	C
3	0	0	0

Course Objective:

- Develop an understanding of the key concepts, definitions a key perspectives of All Hazards Emergency Management
- Understand the Emergency/Disaster Management Cycle
- Have a basic understanding for the history of Emergency Management
- Develop a basic under understanding of Prevention, Mitigation, Preparedness, Response and Recovery
- Develop a basic understanding for the role of public a private partnership.

Course Outcome:

- Understanding foundations of hazards, disasters and associated natural/social phenomena
- Familiarity with disaster management theory (cycle, phases)
- Knowledge about existing global frameworks and existing agreements (e.g. Sendai)
- Methods of community involvement as an essential part of successful DRR
- Humanitarian Assistance before and after disaster
- Technological innovations in Disaster Risk Reduction: Advantages and problems
- Experience on conducting independent DM study including data search, analysis and presentation of disaster case study.
- Respond to disaster risk reduction initiatives and disasters in an effective, humane and sustainable manner.

Module I

Understanding Disasters:

Understanding the concepts and definitions of disaster, hazard, vulnerability, risk, importance, dimensions & scope of Disaster Management, Disaster Management cycle and disaster profile of India.

Module II

Types, Trends, Causes, Consequences and Control of Disaster: Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunderstorms, hail storms, avalanches, droughts, cold and heat waves); Biological Disasters (epidemics, pest attacks, forest fire); Technological Disasters (chemical, industrial, radiological, nuclear, bomb threat, explosion) and Man-made Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters; terrorist attack, sudden shooting); Global Disaster Trends–Emerging Risks of Disasters–Climate Change and Urban Disasters; Financial emergency(risk of eviction, risk in arrears, sudden health emergency, family emergency, unexpected loss of income).

Module III

Prevention and Mitigation of Disaster :Disaster Mitigation: meaning and concept, Disaster Mitigation Strategies Emerging Trends in Disaster Mitigation, Mitigation management, Role of Team and Coordination. Disaster Preparedness: Concept & Nature, Disaster Preparedness Plan, Preventions. Roles & Responsibilities of Different Agencies and Government, Technologies for

Disaster Management. Early Warning System; Preparedness, Capacity Development; Awareness during Disaster.

Module IV

Applications of Science and Technology for Disaster Management & Mitigation: Geo-informatics in Disaster Management (RS, GIS, GPS and RS) Disaster Communication System (Early Warning and Its Dissemination) Land Use Planning and Development, Regulations, Disaster Safe Designs and Constructions, Structural and Non Structural Mitigation of Disasters.

Suggested Reading:

1. *Disaster Management- J. P. Singhal, Laxmi Publications.*
2. *Disaster Management - Dr. Mrinalini Pandey, Wiley India Pvt. Ltd.*
3. *Disaster Science and Management- Tushar Bhattacharya, McGraw Hill Education (India) Pvt. Ltd.*
4. *Disaster Management: Future Challenges and Opportunities - Jagbir Singh, K W Publishers Pvt. Ltd.*

Program: B.Tech

Semester: Four

Course: Professional Practices, Laws & Ethics

Course Code: HSMC202

L	T	P	C
3	0	0	3

Course Objective:

To impart basic skills of Professional Communication in English through basic elements of civil engineering professional practice are introduced in this course. Roles of all participants in the process-owners, developers, designers, consultants, architects, contractors, and suppliers - are described. Basic concepts in professional practice, business management, public policy, leadership, and professional licensure are introduced. The course covers professional relations, civic responsibilities, and ethical obligations for engineering practice. The course also describes contracts management, and various legal aspects related to engineering. Further, the course familiarizes students with elementary knowledge of laws that would be of utility in their profession, including several new areas of law such as IPR, ADR.

Course Outcome:

- Know the definitions and major concepts in ethics
- Understand the ethical approach to decision making
- Follow the assessment criteria steps when making a decision.
- Understand the Code of Conduct.
- Explain the concept of personal ethics and their relationship to business and engineering ethics.
- Describe the role of a code of conduct in a work environment, when following ethical principles.
- Uphold the code of conduct within the work team.
- Identify and solve ethical problems in upholding the code of conduct
- Communicate effectively, when explaining and describing the concept of ethics and the application of a code of conduct.

Module 1 A: Professional Practice – Respective roles of various stakeholders: Government (constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens); Standardization Bodies (ex. BIS, IRC)(formulating standards of practice); professional bodies (ex. Institution of Engineers(India), Indian Roads Congress, IIA/ COA, ECI, Local Bodies/ Planning Authorities) (certifying professionals and offering platforms for interaction); Clients/ owners (role governed by contracts); Developers (role governed by regulations such as RERA); Consultants (role governed by bodies such as CEAI); Contractors (role governed by contracts and regulatory Acts and Standards); Manufacturers/ Vendors/ Service agencies (role governed by contracts and regulatory Acts and Standards)

Module 1 B: Professional Ethics – Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility,

Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures.

Module 2: General Principles of Contracts Management: Indian Contract Act, 1972 and amendments covering General principles of contracting; Contract Formation & Law; Privacy of contract; Various types of contract and their features; Valid & Voidable Contracts; Prime and sub-contracts; Joint Ventures & Consortium; Complex contract terminology; Tenders, Request For Proposals, Bids & Proposals; Bid Evaluation; Contract Conditions & Specifications; Critical /“Red Flag” conditions; Contract award & Notice To Proceed; Variations & Changes in Contracts; Differing site conditions; Cost escalation; Delays, Suspensions & Terminations; Time extensions & Force Majeure; Delay Analysis; Liquidated damages & Penalties; Insurance & Taxation; Performance and Excusable Non-performance; Contract documentation; Contract Notices; Wrong practices in contracting (Bid shopping, Bid fixing, Cartels); Reverse auction; Case Studies; Build-Own-Operate & variations; Public-Private Partnerships; International Commercial Terms;

Module 3 : Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system: Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Award including Form and content, Grounds for setting aside an award, Enforcement, Appeal and Revision; Enforcement of foreign awards – New York and Geneva Convention Awards; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats

Module 4 : *Engagement of Labour and Labour & other construction-related Laws:* Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen’s Compensation Act, 1923; Building & Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017

Module 5 : *Law relating to Intellectual property:* Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970 including Concept and historical perspective of patents law in India, Patentable inventions with special reference to biotechnology products, Patent protection for computer programs, Process of obtaining patent – application, examination, opposition and sealing of patents, Patent cooperation treaty and

grounds for opposition, Rights and obligations of patentee, Duration of patents – law and policy considerations, Infringement and related remedies;

Suggested Readings:

1. B.S. Patil, *Legal Aspects of Building and Engineering Contracts*, 1974.
2. *The National Building Code, BIS*, 2017
3. RERA Act, 2017
4. Meena Rao (2006), *Fundamental concepts in Law of Contract*, 3rd Edn. Professional Offset
5. Neelima Chandiramani (2000), *The Law of Contract: An Outline*, 2nd Edn. Avinash Publications Mumbai
6. Avtarsingh (2002), *Law of Contract*, Eastern Book Co.
7. Dutt (1994), *Indian Contract Act*, Eastern Law House
8. Anson W.R. (1979), *Law of Contract*, Oxford University Press
9. Kwatra G.K. (2005), *The Arbitration & Conciliation of Law in India with case law on UNCITRAL Model Law on Arbitration*, Indian Council of Arbitration
10. Wadhera (2004), *Intellectual Property Rights*, Universal Law Publishing Co.
11. T. Ramappa (2010), *Intellectual Property Rights Law in India*, Asia Law House
12. Bare text (2005), *Right to Information Act*
13. O.P. Malhotra, *Law of Industrial Disputes*, N.M. Tripathi Publishers
14. K.M. Desai(1946), *The Industrial Employment (Standing Orders) Act*
15. Rustamji R.F., *Introduction to the Law of Industrial Disputes*, Asia Publishing House
16. Vee, Charles & Skitmore, Martin (2003) *Professional Ethics in the Construction Industry*, Engineering Construction and Architectural management, Vol.10, Iss2,pp 117-127, MCB UP Ltd
17. American Society of Civil Engineers (2011) *ASCE Code of Ethics – Principles Study and Application*
18. *Ethics in Engineering- M.W.Martin & R.Schinzinger*, McGraw-Hill
19. *Engineering Ethics*, National Institute for Engineering Ethics, USA
20. www.ieindia.org
21. *Engineering ethics: concepts and cases – C. E. Harris, M.S. Pritchard, M.J.Rabins*
21. *CONSTRUCTION CONTRACTS*, <http://www.jnormanstark.com/contract.htm>
22. *Internet and Business Handbook*, Chap 4, *CONTRACTS LAW*
23. <http://www.laderapress.com/laderapress/contractslaw1.html>
24. *Contract&Agreements*
25. <http://www.tco.ac.ir/law/English/agreements/General/Contract%20Law/C.htm>
26. *Contracts*, <http://206.127.69.152/jgretch/crj/211/ch7.ppt>
27. *Business & Personal Law*. Chapter 7. “How Contracts Arise”, <http://yucaipahigh.com/schristensen/lawweb/lawch7.ppt>
28. *Types of Contracts*, <http://cmsu2.cmsu.edu/public/classes/rahm/meiners.con.ppt>
29. *TYPES OF CONTRACTS AND IMPORTANT PROVISIONS*, <http://www.worldbank.org/html/opr/consult/guidetxt/types.html>
30. *Contract Types/Pricing Arrangements Guideline- 1.4.G (11/04/02)*, <http://www.sandia.gov/policy/14g.pdf>