SEMESTER IV

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

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Course Learning Objective:

CLO 1: Ability to apply mathematics, science, and engineering
CLO 2: Ability to design and conduct experiments, as well as to analyze and interpret data
CLO 3: Ability to identify, formulate, and solve engineering problems
CLO 4: Ability to apply modern engineering tools, techniques and resources to solve complex mechanical engineering activities with an understanding of the limitations.
CLO 5: Ability to comprehend the thermodynamics and their corresponding processes thatinfluence the behavior and response of structural components

Course Outcome:

On the completion of the Course, the students 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: To appreciate concepts learnt in fundamentals laws of thermodynamics from whichlearning 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 5: Understand the Psychometry and psychrometric charts, property calculations of air vapour mixtures & Psychrometric process.

Course Content:

Topics	Hours
Unit 1:	**6**
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.	
Unit II:	**6**
First Law of Thermodynamics- Concepts of Internal Energy, Specific Heat Capacities, Enthalpy. Energy Balance for Closed and Open Systems, Energy Balance for Steady-Flow Systems. Steady-Flow Engineering Devices. Energy Balance for Unsteady-Flow.	
Unit III:	**8**
Second Law of Thermodynamics- Thermal energy reservoirs, heat engines energy conversion, 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. perpetual-motion machines, reversible and irreversible processes.	
Unit IV:	**8**
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.	
Unit V:	**8**
Psychrometry and psychrometric charts, property calculations of air vapour mixtures. Psychrometric process – Sensible heat exchange processes. Latent heat exchange processes. Adiabatic mixing, evaporative cooling. Refrigerant property tables. Refrigeration cycles.	

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.*
6.

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

L	T	P	C
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Course Learning Objective:

The objective of this course is to help the students
CLO 1: To develop knowledge on drilling and blasting operations in underground and surface mines.
CLO 2: To design blasting pattern for mines and blast design in surface and underground mines.
CLO 3: To develop knowledge about exploration techniques, drilling operations, casing, various explosives used in opencast & underground.

Course Outcome:

On the completion of the Course, the students 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.

Course Content:

Topics	Hours
Unit 1:	**8**
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.	
Unit II:	**8**
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.	
Unit III:	**10**
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.	
Unit IV:	**10**
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
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Course Learning Objective:

The objective of this course is to help the students
CLO 1: To develop knowledge on economics of ore, exploration and practical site investigation.
CLO 2: To create knowledge about geology of rock, geological disturbances and identification of geological structures in the field.
CLO 3: To know the coal geology and complete geology of petroleum from origin to extraction.

Course Outcome:

On the completion of the Course, the students 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.

Course Content:

Topics	Hours
Unit 1:	**10**
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.	
Unit II:	**10**
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.	
Unit III:	**8**
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.	
Unit IV:	**8**
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

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Course Objective:

1. Study of Geology maps.
2. Study of Contour maps.
3. Maps illustrating fold, fault and unconformity.
4. Demonstration of igneous intrusions: Dykes, Sills, & Batholiths

Program: B.Tech
Semester: Four

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Course: Mine Development
Course Code: 8PCCMiE206

Course Learning Objective:

The objective of this course is to help the students
CLO 1: To develop basic insight to access of deposit methods & shaft sinking along with drifting and tunneling technology.
CLO 2: To incorporate the understanding of methods of driving underground openings & headings.
CLO 3: To appraise the special mining techniques and problems related to sinking & tunneling.

Course Outcome:

On the completion of the Course, the students 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.

Course Content:

Topics	Hours
Unit 1:	**12**
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.	
Unit II:	**8**
Insets: Design, excavation and lining. Mechanized Sinking: Simultaneous sinking and lining; slip-form method of lining; high speed sinking, Shaft Boring: Methods and equipment.	
Unit III:	**10**
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.	
Unit IV:	**6**
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

L	T	P	C
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Course: Mine Surveying II
Course Code: 8PCCMiE207

Course Learning Objective:

The objective of this course is to help the students
CLO 1: To understand & carry out underground surveys and stope measuring.
CLO 2: To develop plotting contour plans
CLO 3: Understand advanced surveying techniques such as remote sensing and geodetic surveying.
CLO 4: The students will have practical knowledge about recent development of surveying and mine planning.
CLO 5: Students are made aware about the modern survey equipment and methods for precision survey.
CLO 6: The students will have practical knowledge about survey instruments and its workings.

Course Outcome:

On the completion of the Course, the students 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.

Course Content:

Topics	Hours
Unit 1:	**10**
Control Surveys: Triangulation–classification of triangulation system, triangulation figures, reconnaissance, selection of station, observation of horizontal angles, base line extension, concept of satellite station, Base line measurement: different types of application of triangulation survey, adjustment of different types of triangulation figure by equal shift methods only.	
Unit II:	**12**
Correlation Survey : Methods of correlation–direct traversing in inclined shaft, correlation in vertical shaft–single and two shaft. 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.	
Unit III:	**8**
Slope Monitoring in Opencast Mines: Geodetic and Remote Sensing, 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.	
Unit IV:	**6**
GIS: Basic concept of GIS, components of GIS, application of GIS, Data structures and formats, spatial data models – Raster and Vector data. Data inputting in GIS. Application of Automation & IT in surveying: 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

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Semester: Four
Course: Mine Surveying II Lab
Course Code: 8PCCMiE207P

List of Experiments:

1. To determine the height of an object by Trigonometric Leveling when base is inaccessible.
2. To determine the height of an object by Trigonometric Leveling when base is accessible.
3. To draw a contour map by square or grid system.
4. Determination of area of a closed traverse using total station.

Program: B.Tech

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Semester: Four
Course: Disaster Management
Course Code: 8MC201

Course Learning Objective:

CLO 1: Develop an understanding of the key concepts, definitions a key perspectives of All Hazards Emergency Management

CLO 2: Understand the Emergency/Disaster Management Cycle

CLO 3: Have a basic understanding for the history of Emergency Management

CLO 4: Develop a basic under understanding of Prevention, Mitigation, Preparedness, Response and Recovery

CLO 5: Develop a basic understanding for the role of public a private partnership.

Course Outcome:

On the completion of the Course, the students will be able to:

CO 1: Understanding foundations of hazards, disasters and associated natural/social phenomena, Familiarity with disaster management theory (cycle, phases)

CO 2: Knowledge about existing global frameworks and existing agreements (e.g. Sendai), Methods of community involvement as an essential part of successful DRR

CO 3: Humanitarian Assistance before and after disaster, technological innovations in Disaster Risk Reduction: Advantages and problems

CO 4: 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.

Course Content:

Topics	Hours
Unit 1:	**4**
Disaster: Understanding the concepts and definitions of disaster, hazard, vulnerability, risk, importance, dimensions & scope of Disaster Management, Disaster Management cycle and disaster profile of India.	
Unit II:	**12**
Types, Trends, Causes, Consequences and Control of Disaster: Geological Disasters (earthquakes, landslides, tsunami, mining);Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, 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).	
Unit III:	**8**
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.	
Unit IV:	**6**
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

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Semester: Four
Course: Professional Practices, Laws & Ethics
Course Code: **8**HSMC202

Course Learning Objective:

CLO 1: To impart basic skills of Professional Communication in English throughbasic 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.
CLO 2: The course covers professional relations, civic responsibilities, and ethical obligations for engineering practice.
CLO 3: The course also describes contracts management, and various legal aspects related to engineering.
CLO 4: 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:

On the completion of the Course, the students will be able to:
CO 1: Know the definitions and major concepts in ethics
CO 2: Understand the ethical approach to decision making
CO 3: Follow the assessment criteria steps when making a decision.
CO 4: Understand the Code of Conduct.
CO 5: Explain the concept of personal ethics and their relationship to business and engineering ethics.
CO 6: Describe the role of a code of conduct in a work environment, when following ethical principles.
CO 7: Uphold the code of conduct within the work team.
CO 8: Identify and solve ethical problems in upholding the code of conduct
CO 9: Communicate effectively, when explaining and describing the concept of ethics and the application of a code of conduct.

Course Content:

Topics	Hours
Unit 1:	**6**
Professional Practice – Respective roles of various stakeholders: Government(constituting regulatory bodies; Standardization Bodies (ex. BIS, IRC)(formulating standards of practice); professional bodies (ex. Institution of Engineers(India), Local Bodies/ Planning Authorities); Clients/ owners (role governed by contracts); Developers (role governed by regulations such as RERA	
Unit II:	**6**
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; Bids & Proposals; Bid Evaluation; Cost escalation; Delays, Suspensions & Terminations; Time extensions & Force Majeure; Delay Analysis; Insurance & Taxation; Contract documentation; Contract Notices; Wrong practices in contracting (Bid shopping, Bid fixing, Cartels).	
Unit III:	**6**
Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law – Arbitration and expert determination; 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, Enforcement, Appeal and Revision.	
Unit IV:	**4**
Industrial Disputes Act, 1947; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923.	
Unit V:	**8**
Law relating to Intellectual property: Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment; Law relating to Patents under Patents Act, 1970 including Concept and historical perspective of patents law in India, Patent protection for computer programs, Process of obtaining patent – application, examination, opposition and sealing of patents, 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. *NeelimaChandiramani (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 Publisher*