Scheme of Instruction, Evaluation

and

Syllabi of

B.E. MINING ENGINEERING

With effect from Academic Year 2022-23

DEPARTMENT OF MINING ENGINEERING

UNIVERSITY COLLEGE OF ENGINEERING

(Autonomous)

Osmania University

Hyderabad – 500 007, TS, INDIA

Estd.1917

Estd.1929

INSTITUTION

The University College of Engineering (UCE) has the distinction of being the oldest and the biggest among the Engineering Colleges of the State of erstwhile Andhra Pradesh. Established in the year 1929, eleven years after the formation of Osmania University, it was the 6th Engineering College to be established in the whole of British India. The College moved to its present permanent building in the year 1947. Today it is the biggest among the campus colleges of Osmania University. The Golden Jubilee of the College was celebrated in 1979, the Diamond Jubilee in 1989 and the Platinum Jubilee in 2004. The College was made autonomous in 1994.
The Institute offers eight UG programmes (AI&ML, Biomedical, Civil, Computer Science, Electrical and Electronics, Electronics and Communications, Mechanical and Mining Engineering) and 22 PG programmes in various specializations. The University College of Engineering (A) is the first Engineering College to get ISO: 9001 Certification in Rank by NIRF, MHRD. The College also offers Ph.D., programmes in various areas of specialization in the various branches of Engineering. Part-time courses are also being offered at postgraduate levels.

Vision

The Vision of the institute is to generate and disseminate knowledge through harmonious blending of science, engineering and technology. To serve the society by developing a modern technology in students' heightened intellectual, cultural, ethical and humane sensitivities, fostering a scientific temper and promoting professional and technological expertise.

Mission

- To achieve excellence in Teaching and Research
- To generate , disseminate and preserve knowledge
- To enable empowerment through knowledge and information
- Advancement of knowledge in Engineering, Science and Technology
- Promote learning in free thinking and innovative environment
- Cultivate skills, attitudes to promote knowledge creation
- Rendering socially relevant technical services to the community
- To impart new skills of technology development
- To inculcate entrepreneurial talents and technology appreciation programmes
- Technology transfer and incubation

DEPARTMENT

The Department of Mining Engineering was established in 1956 at University College of Engineering, Osmania University, Hyderabad. Later, with a view to impart hands on field experience and very good exposure to the mining industry, the Department of Mining Engineering, was relocated to Kothagudem in 1978 amidst the coalfields of The Singareni Collieries Company Ltd. and rechristened as The Kothagudem School of Mines (KSM). In 1994, the Kothagudem School of Mines was handed over to Kakatiya University and is being called as UCE, KU.
The Department of Mining Engineering was re-started during 2018-19 in OUCE during Osmania University Centenary Celebrations with M.E. in Mining Engineering, Subsequently B.E in Mining Engineering was started from the academic year 2021-22. Establishment of this department is well supported by Industry and Alumni of Mining Engineers.

Vision

To be as a leading academic department on pace with global standards and contribute to the development of economic, technically viable and useful to societal problems and challenges of Mining engineering profession and also contribute to the regional and country's developmental activities.

Mission

- To produce highly competent and capable professionals to face the challenges and provide viable solutions to Mining Engineering problems
- Integration of their knowledge and skills to excel in the profession through continuous learning and contribute to the well-being of the society.
- To enhance the technical knowledge, research aptitude to serve the society in highly competent manner.

Programme Educational Objectives (PEO):

PEO1: Impart basic knowledge in the field of Mining Engineering.
PEO2: Develop skills to analyse and provide viable solutions to various Mining Engineering problems.
PEO3: Enhance communication skills and encourage team work.
PEO4: Prepare Mining Engineering professionals with zeal for research, life-long learning, and work for sustainable development of society with ethics.

PROGRAM OUTCOMES (POs)

POs	Engineering Graduates will be able to:
PO1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Lifelong learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.
	PROGRAM SPECIFIC OUTCOMES (PSOs)
PSO1	**Analytical Skill :** Ability to plan, execute, manage and rehabilitate Mining Engineering systems and processes
PSO2	**Entrepreneurial Skill :** Ability to become independent practitioners, consultant and entrepreneurs in the field of Mining Engineering

MAPPING OF PEO'S WITH PO'S

S. No.	PEO Statement	M1	M2	M3
PEO 1	Impart basic knowledge in the field of Mining Engineering	3	2	2
PEO 2	Develop skills to analyse and provide viable solutions to various Mining Engineering problems.	3	3	2
PEO 3	Enhance communication skills and encourage team work.	2	2	1
PEO 4	Prepare Mining Engineering professionals with zeal for research, life-long learning, and work for sustainable development of society with ethics.	3	3	3

Rubrics

1 : Weakly mapped

2 : Moderately mapped

3 : Strongly mapped

PEO	Justification and rationale of the mapping
PEO 1	Mainly focuses on imparting basic knowledge in Mining Engineering to produce highly competent and capable professionals. Accordingly, the correlations are assigned.
PEO 2	Emphasis is on training to inculcate analytical skills to design various Mining Engineering problems. Hence, the correlations are allotted.
PEO 3	Focuses on personality development, character building and to work with peers. Therefore, the correlations are justified.
PEO 4	Equip with required skills to effectively tackle the real life problems of Mining Engineering in sustainable manner. Therefore, M1 to M3 are in good agreement.

Mapping of PEOs with POs

PROGRAMME EDUCATIONAL OBJECTIVES	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
PEO-1	3				3				1	1		1	1	
PEO-2	3				3				1	1		1	1	
PEO-3	3				3				1	1		1	1	
PEO-4	3				3				1	1		1	1	
PEO-5														

SEMESTER WISE SCHEMA WITH CREDITS

Scheme of Instruction for BE (Mining Engineering) for 8 Semesters

S. No.	Programme Work-Subject Area	Credits/Semester								Credits
		I	II	III	IV	V	VI	VII	VIII	
1.	Humanities and Social Sciences (HS)	4								**4**
2.	Basic Sciences (BS)	7.5	7.5	3						**18**
3.	Engineering Sciences (ES)	10	11	7	6					**34**
4.	Professional Subjects- Core (PC)		3	13	14	17	14	14		**75**
5.	Professional Subjects-Electives(PE)				3	3	3	3		**12**
6.	Open Subjects-Electives (OE)						3	3		**6**
7.	Project Work, Seminar and/or Internships (PW)			2		2	3	5	6	**18**
9.	Mandatory Programmes (MC) (*Credit*)									
	TOTAL	**21.5**	**21.5**	**25**	**23**	**22**	**23**	**25**	**6**	**167**
8.	Mandatory Programmes (MC) (*Non-Credit*)									
	Contact Hours/ Week	**28**	**25**	**25**	**25**	**22**	**28**	**28**	**21**	

Scheme of Instruction for BE (Mining Engineering) - I Semester

S. No.	Course Code	Course Title	Scheme of Instruction			Contact Hrs/ Week	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
THEORY										
1	MC100 HS	Induction Program	2 weeks							
2	BS 101 MT	Engineering Mathematics-I	3	-	-	3	3	40	60	3
3	BS 101 CH	Engineering Chemistry	3	-	-	3	3	40	60	3
4	HS 101 EG	Communicative English	3	-	-	3	3	40	60	3
5	ES 101 CE	Engineering Mechanics	3	-	-	3	3	40	60	3
PRACTICALS										
6	BS 151 CH	Engineering Chemistry Lab	-	-	3	3	3	25	50	1.5
7	HS 151 EG	Communicative English Lab	-	-	2	2	3	25	50	1
8	ES 151 CE	Engineering Graphics	2	-	4	6	3	25	50	4
9	ES 152 ME	Workshop Practice	-	-	6	6	3	25	50	3
		Total	**14**	**00**	**14**	**28**	**24**	**260**	**440**	**21.5**

Scheme of Instruction for BE (Mining Engineering) - II Semester

S. No.	Course Code	Course Title	Scheme of Instruction			Cont.Hrs/ Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
THEORY										
1	BS 201 MT	Engineering Mathematics-II	3	-	-	3	3	40	60	3
2	BS 201 PH	Engineering Physics	3	-	-	3	3	40	60	3
3	ES 101 CS	Computer Programming for Problem Solving	3	-	-	3	3	40	60	3
4	PC 201 MN	Introduction To Mining Engineering	3	-	-	3	3	40	60	3
5	ES 101 EE	Basic Electrical Engineering	3	-	-	3	3	40	60	3
PRACTICALS										
6	BS 251 PH	Engineering Physics Lab	-	-	2	2	3	25	50	1.5
7	ES 151 CS	Computer Programming for Problem Solving Lab	-	-	2	2	3	25	50	1
8	ES 251 MN	Machine Drawing Practice	2	-	4	6	3	25	50	4
		Total	**17**	**00**	**08**	**25**	**24**	**275**	**450**	**21.5**
* At the end of II semester students should undergo Internship-I (UG Mines) (Metal/Coal) during vacation. Marks will be awarded in III semester.										

L : Lectures
P : Practical's
T : Tutorials
SEE : Semester End Examination
CIE : Continuous Internal Evaluation

Scheme of Instruction for BE (Mining Engineering) - III Semester

S. No.	Course Code	Course Title	Scheme of Instruction			Cont. Hrs/ Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
THEORY										
1	BS 301 MT	Engineering Mathematics-III	3	-	-	3	3	40	60	3
2	PC 301 MN	Development of Mineral Deposits	3	-	-	3	3	40	60	3
3	PC 302 MN	Underground Coal Mining	3	-	-	3	3	40	60	3
4	PC 303 MN	Mine Environmental Engineering-I	3	-	-	3	3	40	60	3
5	PC 304 MN	Engineering Geology	3	-	-	3	3	40	60	3
6	ES 302 CE	Introduction to Fluid Mechanics	3	-	-	3	3	40	60	3
7	ES 401 ME	Elements of Mechanical Engineering	3	-	-	3	3	40	60	3
PRACTICALS										
8	ES 351 CE	Fluid Mechanics- lab	-	-	2	2	3	25	50	1
9	PC 351 MN	Engineering Geology Lab	-	-	2	2	3	25	50	1
10	PW 921 MN	Internship-I	-	-	_	-	2	50	-	2
			21	**0**	**04**	**25**	**29**	**380**	**520**	**25**

Note: Evaluation of Internship Grade: Satisfactory/ Good/ Excellent

Scheme of Instruction for BE (Mining Engineering) - IV Semester

S.No.	Course Code	Course Title	Scheme of Instruction			Cont Hrs/ Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
THEORY										
1	PC401 MN	Surface Mining Technology	3	-	-	3	3	40	60	3
2	PC 402 MN	Mining Machinery I	3	-	-	3	3	40	60	3
3	PC 403 MN	Mine Environmental Engineering-II	3	-	-	3	3	40	60	3
4	PC 404 MN	Mine Surveying	3	-	-	3	3	40	60	3
5	ES 404 ME	Strength of Materials	3	-	-	3	3	40	60	3
6		PE - I	3			3	3	40	60	3
7	ES 401 EC	Basic Electronics Engineering	3	-	-	3	3	40	60	3
PRACTICALS										
8	PC 451MN	Mine Surveying Lab	-	-	2	2	3	25	50	1
9	PC 452 MN	Mining Environmental Lab	-	-	2	2	3	25	50	1
			21	**0**	**04**	**25**	**27**	**330**	**520**	**23**

* At the end of IV semester students should undergo Survey camp (during vacation). Marks will be awarded in V semester.

CODE	PROFESSIONAL ELECTIVE-I
PE 411 MN	Mine Surface Environment Management
PE 412 MN	Sustainable Mineral Industry
PE413 MN	Mineral Exploration

Scheme of Instruction for BE (Mining Engineering) - V Semester

S.No.	Course Code	Course Title	Scheme of Instruction			Contact Hrs/ Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
THEORY										
1	PC 501 MN	Drilling and Blasting	3	-	-	3	3	40	60	3
2	PC 502 MN	Mining Machinery II	3	-	-	3	3	40	60	3
3	PC 503 MN	Mineral processing	3	-	-	3	3	40	60	3
4	PC 504 MN	Advanced Surveying Techniques	3	-	-	3	3	40	60	3
5	PC 505 MN	Rock Mechanics	3	-	-	3	3	40	60	3
6		PE II	3	-	-	3	3	40	60	3
PRACTICALS										
7	PC 551 MN	Mining Machinery Lab	-	-	2	2	3	25	50	1
8	PC 552 MN	Mineral Processing Lab	-	-	2	2	3	25	50	1
9	PW 941 MN	Survey Camp (Report)	-	-	-	-	-	50	-	2
			18	**0**	**04**	**22**	**24**	**340**	**460**	**22**

Note: Evaluation of Survey Camp Grade: Satisfactory/ Good/ Excellent

CODE	PROFESSIONAL ELECTIVE-II
PE 521 MN	Mining Instrumentation And Automation
PE 522 MN	Surface Coal mining and Mechanization
PE523 MN	Mine Disasters & Rescue

Scheme of Instruction for BE (Mining Engineering) - VI Semester

S.No.	Course Code	Course Title	Scheme of Instruction			Cont Hrs/ Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
THEORY										
1	PC 601 MN	Mine Ground Control	3		-	3	3	40	60	3
2	PC 602 MN	Underground Metal Mining	3	-	-	3	3	40	60	3
3		PE-III	3	-	-	3	3	40	60	3
4		OE I	3	-	-	3	3	40	60	3
5	PC 603 MN	Rock Excavation engineering	3	-	-	3	3	40	60	3
6	PC 604 MN	Computer Applications in Mining	3	-	-	3	3	40	60	3
PRACTICALS										
7	PC 651 MN	Computer Applications in Mining Lab	-	-	2	2	3	25	50	1
8	PC 652 MN	Rock Mechanics Lab	-	-	2	2	3	25	50	1
9	PW653MN	Mini Project	-	-	6	6	-	50	-	3
			18	**0**	**10**	**28**	**24**	**340**	**460**	**23**

* At the end of VI semester students should undergo Internship-II (OC Mines) (Coal/Metal). Marks will be awarded in VII semester.

CODE	PROFESSIONAL ELECTIVE-III	CODE	OPEN ELECTIVE-I
PE 631 MN	IoT Applications in Mining	OE-611MN	Introduction to Mining Technology/ Benefit to Society from Mining Industry
PE 632 MN	Material Management in Mines		
PE633 MN	Coal Bed Methane And Coal Gasification		

Scheme of Instruction for BE (Mining Engg) - VII Semester

S.No.	Course Code	Course Title	Scheme of Instruction			Contact Hrs/ Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
THEORY										
1	PC701 MN	Mine Legislation	3	-	-	3	3	40	60	3
2	PC702MN	Mine Economics	3	-	-	3	3	40	60	3
3	PC703MN	Numerical Modelling In Mining	3	-	-	3	3	40	60	3
4	PC704MN	Rock Slope Engineering	3	-	-	3	3	40	60	3
5	OE -II	OE II	3	-	-	3	3	40	60	3
6		PE IV	3	-	-	3	3	40	60	3
PRACTICALS										
7	PC751MN	Seminar	-	-	2	2	3	50	-	1
	PC752MN	Comprehensive subject	2	-	-	2	2	50	-	1
8	PW761MN	Project Work-I	-	-	6	6	3	50	-	3
9	PW961MN	Internship-II					2	50	-	2
			20	**0**	**8**	**28**	**26**	**390**	**360**	**25**

Evaluation of Internship-II Grade: Satisfactory/ Good/ Excellent

CODE	PROFESSIONAL ELECTIVE-IV	CODE	OPEN ELECTIVE-II
PE741MN	Mine Planning	OE721MN	Solid Fuel Technology
PE742MN	Geo-Statistics		
PE743MN	Deep Sea Mining		

Scheme of Instruction for Be (Mining Engg) – VIII Semester

S.No.	Course Code	Course Title	Scheme of Instruction			Contact Hrs/ Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
THEORY										
1	Mandatory Course I	Constitution of India	3	-	-	3	3	40	60	0
2	MC II	Artificial Intelligence	3	-	-	3	3	40	60	0
3	MC III	Environmental Sciences	3			3	3	40	60	0
PRACTICALS										
4	PW891MN	Project Work-II	-	-	12	12	-	50	100	6
			9	**0**	**12**	**21**	**9**	**170**	**280**	**6**

Scheme of Instruction, Evaluation

and

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B.E. MINING ENGINEERING
(I &II Semesters)

With effect from Academic Year 2022-23

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SEMESTER WISE SCHEMA WITH CREDITS

Scheme of Instruction for BE (Mining Engineering) - I Semester

S.No.	Course Code	Course Title	Scheme of Instruction			Contact Hrs/ Week	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
THEORY										
1	MC100HS	Induction Program	3 weeks							
2	BS101MT	Engineering Mathematics-I	3	-	-	3	3	40	60	3
3	BS102CH	Engineering Chemistry	3	-	-	3	3	40	60	3
4	HS101EG	Communicative English	3	-	-	3	3	40	60	3
5	ES101CE	Engineering Mechanics	3	-	-	3	3	40	60	3
PRACTICALS										
6	BS151CH	Engineering Chemistry Lab	-	-	2	2	3	25	50	1.5
7	HS151EG	Communicative English Lab	-	-	2	2	3	25	50	1
8	ES151CE	Engineering Graphics	2	-	4	6	3	25	50	4
9	ES151ME	Workshop Practice	-	-	6	6	3	25	50	3
		Total	**14**	**00**	**12**	**26**	**24**	**260**	**440**	**21.5**

L : Lectures T : Tutorials
P : Practical Dr. : Drawing
CIE : Continuous Internal Evaluation SEE : Semester End Evaluation

Induction Program
2 weeks
(Classroom teaching on various issues, campus visits and outside of the campus visit to bring awareness to the students about the future 4 years learning process at UCE, OU)

BS 101 MT	**ENGINEERINGMATHEMATICS–I** **(Common to all Branches)** **I Year I Semester**					
Pre-requisites	Mathematical Knowledge of 12th / Intermediate level		**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1	To Introduce the Concepts of Sequences, Series and their Properties.
2	To Study the Concepts of Mean Value Theorems.
3	To Introduce the Concepts of Functions of Several Variables and its Applications.
4	To Introduce the Concepts of Multiple Integrals and its Applications
5	To Study Vector Differential and Integral Calculus.

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Find the Nature of Sequences and Series
CO-2	To Apply the Mean Value Theorem and to Find the Roots of Continues Functions
CO-3	To find the Maximum and Minimum Values of Multiple Variable Functions.
CO-4	Use the Knowledge of Multiple Integrals in Finding the Area and Volume of any Region Bounded by Given Curves
CO-5	Apply the Knowledge of Vector Calculus to Find Line, Surface and Volume Integrals.

Articulation matrix of Course outcomes with PO's:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO 2
CO 1	3	2	2	1	1	1	-	-	1	-	-	2	-	-
CO 2	3	2	1	2	2	2	-	-	1	-	-	2	-	-
CO 3	3	2	2	3	2	2	-	-	1	-	-	2	-	-
CO 4	3	2	1	1	1	2	-	-	1	-	-	2	-	-
CO 5	3	2	2	3	1	2	-	-	1	-	-	2	-	-

Correlation rating: Low/Medium/High: 1/2/3respectively.

UNIT–I

Sequences and Series:

Sequences, Series, General properties of series, Series of positive terms, Comparison tests, P- test, tests of Convergence, D'Alembert's ratio test, Cauchy's n^{th} root test, Raabe's test, Integral test, Alternating series, Series of positive and negative terms, Absolute convergence and Conditional convergence.

UNIT- II

Calculus of one variable:
Rolle's Theorem, Lagrange's, Cauchy's mean value theorems (without proof) Taylor's series, Curvature, Radius of curvature, Circle of curvature, Envelope of a family of curves, Evolutes and Involutes

UNIT- III

Multi variable Calculus (Differentiation):

Functions of two variables, Limits and continuity, Partial derivatives, Total differential and differentiability, Derivatives of composite and implicit functions (Chain rule),Change of variables, Jacobian Higher order partial derivatives, Taylor's series of functions of two variables, Maximum and minimum values of functions two variables ,Lagrange's method of multipliers.

UNIT- IV

Multi variable Calculus (Integration):

Double integrals, Change of order of integration, Triple integrals, Change of variables in integrals and applications- areas and volumes, Beta and Gamma functions.

UNIT-V

Vector Calculus:
Scalar and vector fields, Gradient of a scalar field, Directional derivative, Divergence and Curl of a vector field, Line, Surface and Volume integrals , Green's theorem in a plane, Gauss's divergence theorem, Stoke's theorem (without proofs) and their verification

Suggested Readings:

1	R. K. Jain & S.R.K Iyengar, Advanced Engineering Mathematics, Narosa Publications, 4^{th} Edition 2014.
2	Erwin Kreyszi, Advanced Engineering Mathematics, John Wiley, 9^{th} Edition, 2012.
3	B.S. Grewal, Higher Engineering Mathematics, Khanna Publications, 43^{rd} Edition, 2014.
4	G.B. Thomas, Maurice Weirand Joel Hass, Thomas Calculus, Peterson, 12^{th} Edition, 2010.
5	B.V .Ramana, Higher Engineering Mathematics, 23^{rd} reprint, 2015.
6	N.P. Bali and M.Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2010.
7	H.K. Dass, Er. Rajnish Varma, higher Engineering Mathematics, S.Chand Technical 3^{rd} Edition.

BS 101 CH	ENGINEERING CHEMISTRY					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1	Understand the fundamentals of application of water chemistry in industry and applications of principles of corrosion to minimize corrosion and associated problems.
2	Gain the knowledge of application of Electrochemical principles to construct the electrodes for various purposes and the criterion for determination of feasibility of processes.
3	Analyze and interpret the structure of molecules by applying basic principles of spectroscopy.
4	Acquire knowledge of biopolymers used for medical purposes with various applications.
5	Grasp the latest application of nano-technology in various industries and manufacturing different kinds of batteries.

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	Attains knowledge about the disadvantages of hard water for domestic and industrial purposes. Also teaches the techniques of softening of hard water and treatment of water for drinking purpose and throws light on prevention of corrosion
CO-2	Rationalize bulk properties and processes using thermodynamic considerations.
CO-3	A Distinguishes the ranges of electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.
CO-4	Analyze the basic methods of reactions of organic molecules and study their properties.
CO-5	Knowing about different batteries, fuel cells and their applications of nanomaterials.

Course outcome	Program Outcome											
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO-1	3	3	2	1	1	1	1					2
CO-2	3	3	2	1	1	1	1					1
CO-3	2	2	1	1	1	1	-					1
CO-4	2	2	2	1	1	1	-					1
CO-5	2	2	2	2	1	1	-					2

UNIT – I WATER CHEMISTRY AND CORROSION (10L):

Water chemistry: Hardness of water-Types and UNITs of hardness, estimation of temporary and permanent hardness of water by EDTA method. Alkalinity of water and its determination

Water softening by Ion exchange and Reverse Osmosis methods. Boiler troubles-scales and sludges formation-causes, effects and prevention. Numerical problems. Specifications of potable water. Water treatment for drinking purpose-coagulation, sedimentation, filtration, sterilization by Chlorination.

Corrosion-causes and its effects. Types of corrosion-Dry or Chemical corrosion and Wet or Electrochemical corrosion and their mechanism. Electrochemical corrosion and its types. Factors influencing rate of corrosion.

Corrosion control methods: Cathodic protection methods- Sacrificial anodic and impressed current cathodic protection methods. Surface coating methods: Hot dipping-Galvanizing and Tinning.

UNIT – II

THERMODYNAMICS AND ELECTRO CHEMISTRY(10L):

Thermodynamics: Terminology of Thermodynamics, thermodynamic processes, Work done in Reversible isothermal and adiabatic processes, efficiency of heat engine by Carnot cycle, concept of entropy, physical significance of entropy, Work function, Gibbs free energy and their significance, variation of free energy with temperature and pressure, criteria of spontaneity in terms of entropy and free energy-Numerical.

Electrochemistry: Electrochemical cells- Electrolytic and Galvanic cells-notation, cell reaction and cell potentials. Types of electrodes-Calomel, Quinhydrone and Glass electrodes. Determination of P^H of a solution by using Quinhydrone electrode. Thermodynamics of emf of cells-Nernst equation and its derivation. Application of Nernst equation to electrode potential and emf of cells. Numericals.

Principles and applications of Potentiometric titrations.

UNIT – III
MOLECULAR STRUCTURES AND SPECTROSCOPY (10L): **Molecular Orbital Theory**. Linear Combination of Atomic Orbital's (LCAO).Molecular Orbital energy level diagrams of diatomic molecules-O_2,N_2 and NO.
Description of Electromagnetic spectrum. ***Principles of UV-Visible Spectroscopy: Statement of Beer-Lambert Law.*** Absorption and intensity shifts: Bathochromic, Hypsochromic, Hyper chromic and Hypo chromic shifts with one example each. Principle and applications of UV Sensors. ***IR Spectroscopy:*** Principle of IR Spectroscopy.IR active and IR inactive molecules (two examples each). Principle and applications of IR Sensors. ***NMR Spectroscopy:*** Principle of H^1-NMR Spectroscopy. Multiplicity, Chemical Shift. Principle and Applications of MRI.

UNIT- IV
Organic Reactions: Introduction to Addition, Substitution and Elimination reactions. Addition to C=C and C=O, Nucleophilic substitution in aliphatic system: SN1 and SN2 mechanism, Elimination reactions: E1 and E2 mechanism.
Polymers: Introduction, Classification of polymers -Plastics, Fibres and Elastomers. Preparation, properties and engineering applications of the following polymers: Plastics: PVC and Bakelite Fibers: Nylon 6:6, and Dacron. Elastomers: Buna-S and Butyl Rubber. Conducting polymers: Introduction. Mechanism of conduction in polymers. Intrinsic conducting polymers: Poly-acetylene and poly-aniline. Applications of conducting polymers

UNIT – V
Energy Sources and Nanomaterials (8L) **Batteries:** Primary batteries-Zn carbon battery. Secondary batteries-Pb- Acid battery and Ni-Cd battery. Lithium-ion batteries- advantages and applications. **Fuel cells**: Concept of fuel cells and their advantages. Construction and working of H_2-O_2 and methanol-Oxygen fuel cells. **Solar cells**: Concept of solar energy conversion, photovoltaic cells.
Nanomaterials: Introduction. Properties of nanomaterials. Synthesis of nanomaterials-Top down, Bottom up approach and Sol-gel method. Applications of nanomaterials.

Suggested Reading:

1	Jain & Jain, *Engineering chemistry*, Dhanpat Rai publishing Co.,16th Edition.
2	B.L.Tembe,Kamaluddin and M.S.Krishnan, Engineering Chemistry(NPTELWeb-book)
3	PrashanthRath, Engineering Chemistry, Cengage Learning.
4	M.J.Sienko and R.A.Plane, Chemistry: Principles and Applications, MGH Publishers.
5	B.H.Mahan, University Chemistry, Pearson Publishing Co., 4th Edition.
6	C.N. Banwell, *Fundamentals of Molecular Spectroscopy*, TMH

HS 101 EG	COMMUNICATIVE ENGLISH				
Pre-requisite	English proficiency above B1 level as per the CEFR (Common European Framework of Reference) for languages		**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1	Communicate clearly, accurately and appropriately using correct grammar and vocabulary
2	Write effective paragraphs and essays using devices of coherence & cohesion
3	Write business letters and emails
4	Demonstrate the ability to employ a range of critical to inferential reading.
5	Employ active and passive voice in engineering and scientific contexts to compile technical reports

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	Heighten the awareness of correct usage of English grammar and vocabulary in writing and speaking besides improving their fluency and comprehensibility
CO-2	Develop their ability as critical readers and writers and will produce paragraphs independently on any context with coherence
CO-3	Draft effective business letters and emails
CO-4	Exercise critical reading skills by enhancing the quality of life and to support lifelong learning.
CO-5	Will produce short reports using the drafting process

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	-	-	-	-	-	-	-	-	1	3	-	3	-	-
CO2	-	-	-	-	-	-	-	-	1	3	-	3	-	-
CO 3	-	-	-	-	-	-	-	-	1	3	-	3	-	-
CO4	-	-	-	-	-	-	-	-	1	3	-	3	-	-
CO 5	-	-	-	-	-	-	-	-	1	3	-	3	-	-

UNIT – I
Importance of listening, Importance of reading, Importance of communication, types of communication, Discourse markers & linking words, Homonyms, Homophones, Homographs , Concord

UNIT – II
Types of listening, Reading skills-skimming, scanning, intensive and extensive reading, Communication barriers, Paragraph & Precise writing, One word substitutes, Tenses
UNIT – III
Dos and don'ts of listening, Types of comprehension questions, Styles of communication Essay writing, Root words, Active and Passive voice
UNIT – IV
Listening for specific purposes, Critical reading passages, Proverb expansion through JAM, Letter writing, Email writing, Synonyms, Antonyms, Common errors-I
UNIT – V
Listening to various texts –contd . . . (in language laboratory), Inferential reading passages, Effective presentations, Report writing , Idioms & Phrases, Common Errors-II

Suggested Reading

1	Ashraf, M Rizvi. Effective Technical Communication. Tata McGraw-Hill, 2006
2	Language and LifeASkillsApproach,OrientBlackSwan,2018
3	Michael Swan, Practical English Usage. OUP,1995.
4	Meenakshi Raman and Sangeetha Sharma. Technical Communication: Principles and Practice 2nd Edition, Oxford University Press, 2011
5	Singer F L. (1975). *Engineering Mechanics Statics and Dynamics*, 3rd Edition, Harper Collins International Edition.

ES 101 CE	ENGINEERING MECHANICS					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives:	
1	Understand the resolution of forces, equilibrium of force systems
2	Learn the analysis of forces in the structures
3	Understand the concept of centroid, moment of inertia and dynamics

Course Outcomes:	
CO-1	Determine the resultant and moment of a force system
CO-2	Apply the equations of equilibrium for a generalized force system
CO-3	Analyze the forces in trusses and frames
CO-4	Determine the centroid and moment of inertia for 1D & 2D bodies
CO-5	Apply the concepts of dynamics in solving the engineering problems

UNIT I
Introduction to Engineering Mechanics covering: Force Systems Basic concepts, Particle equilibrium in 2D & 3D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy

UNIT – II
Basic Structural Analysis covering: Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines.

UNIT III
Centroid and Centre of Gravity covering: Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.

UNIT - IV
Virtual Work and Energy Method-Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.

UNIT - V
Mechanical Vibrations covering**,** Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums

Suggested Reading:	
1	F.L. Singer, *Engineering Mechanics*, Collins, Singapore, 1975.
2	S.P. Timoshenko and D.H. Young, *Engineering Mechanics*, McGraw-Hill International Edition, 1983.
3	S. Rajeshakharam and G. Sankarasubrahmanyam, *Mechanics*, Vikas Publications, 2002.
4	S.B. Junarkar and H.J. Shah, *Applied Mechanics*, 2001.
5	J.H. Shames, *Engineering Mechanics*, Prentice Hall, 1987.
6	B. Bhattacharyya, *Engineering Mechanics*, Oxford Higher Education, 2015.

e-Resources:
1. http://nptel.ac.in/
2. http://mhrd.gov.in/e-contents
3. http://spoken-tutorial.org/

BS 151 CH	ENGINEERING CHEMISTRY LAB					
Pre-requisites			**L**	**T**	**P**	**C**
			-	-	2	1.5
Evaluation	**SEE**	**50 Marks**	**CIE**		**25 Marks**	

Course Objectives:	
The course taught with objectives of enabling the student to:	
1	Determination of hardness of water by Complexometry.
2	Estimation of HCL by conductometry and Potentiometry.
3	Verification of Beers law and estimation of $KMnO_4$ by colorimetry.
4	To determine the rate constant of reactions from concentration as a function of Time
5	Synthesis of organic compounds.

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	Estimate the strength of acids and ions present in unknown solution by conductometry and potentiometry.
CO-2	Estimate the concentration of ions present in unknown solution from the absorbance by colorimetric analysis.
CO-3	Conduct experiment to estimate hardness of industrial water.
CO-4	Estimate the rate constants of reactions from concentration of reactants/products as a function of time.
CO-5	Synthesize small drug molecules.

Course outcome	**Program Outcome**											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	2	2	1	1	1	-						2
CO-2	2	2	1	1	1	-						2
CO-3	2	2	2	1	-	-						2
CO-4	2	2	2	1	1	-						2
CO-5	1	1	2	1	-	1						1

Correlation rating : Low / Medium / High : 1 / 2 / 3 respectively.

SYLLABUS:

Experiment - I
1. Estimation of HCL by Conductometry.

Experiment – II
Estimation of Acetic Acid by Conductometry.

Experiment - III
Estimation of HCL by Potentiometry.

Experiment - IV
Estimation of $KMnO_4$ by Potentiometry.

Experiment – V
Verification of Beer's law.and Estimation of $KMnO_4$ by colorimetry.

Experiment – VI
Verification of Beer's law and Estimation of $CuSO_4$ by colorimetry.

Experiment - VII
Determination of Partition Coefficient of Acetic acid in BuOH and water.

Experiment - VIII
Synthesis of Acetyl Salicylic Acid (Aspirin).

Experiment - IX
Estimation of Total hardness of water by Complexometry.

Experiment – X
Estimation of Permanent and Temporary hardness of water by Complexometry.

Experiment - XI
Determination of Chloride content of water by Precipitation method.

Experiment - XII
Determination of Order of Acid catalysed Hydrolysis of Methyl acetate reaction.

Suggested Readings:

1. Senior practical Physical chemistry by BD Khosla, A.Ghulati, VC.Garg., ,R.Chand and Co., New Delhi 10th ed. 2001.
2. Laboratory Manual in Engineering Chemistry, S.K. Bhasin and Sudha Rani Dhanpath Rai Publishing Co.,

HS 151 EG	COMMUNICATIVE ENGLISH LAB				
Pre-requisites	English proficiency above B1 level as per the CEFR (Common European Framework of Reference) for languages.		**L**	**T**	**P**	**C**
			2	-	-	1
Evaluation	**SEE**	50 Marks	**CIE**		25 Marks	

Course Objectives :	
The course is taught with the objectives of enabling the student to	
1	Learn IPA and the transcription; using dictionary to decode phonetic transcription; overcome the difficulties with sounds of English; self learning through CALL
2	Demonstrate and use English speech sounds, stress and intonation in day-to-day situations/conversations/interactions
3	Introducing oneself in various contexts : Social, Academic and Professional
4	Improve listening and understand various accents – GIE, RP and GenAm
5	Learn to participate in various contexts – extempore, group discussions, and presentations

Course Outcomes :	
On completion of this course, the student will be able to	
CO-1	Sensitize the nuances of English speech sounds with computer-assisted individualized and independent language learning
CO-2	Use better pronunciation and right accent and intonation
CO-3	Use functional English
CO-4	Listen and speak effectively by understanding various accents
CO-5	Increase possibilities of job prospects and communicate confidently

Program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	1	3	-	3	-	-
CO2	-	-	-	-	-	-	-	-	1	3	-	3	-	-
CO3	-	-	-	-	-	-	-	-	1	3	-	3	-	-
CO4	-	-	-	-	-	-	-	-	1	3	-	3	-	-
CO5	-	-	-	-	-	-	-	-	1	3	-	3	-	-

UNIT - I
English Sound system: Sounds of English, Vowels, Consonants, using dictionary to decode phonetic transcription, transcription exercises with the help of CALL (Computer Aided Language Lab)
UNIT - II
Stress and Intonation: Syllable, Word stress and its importance, Intonation-falling and rising tone
UNIT - III
Introductions and Presentation skills: In social, formal, academic and professional contexts; JAM, Picture description/perception; Role plays: use of dialogues in various situations and settings; Occasions to give various presentations with emphasis on visual aids and body language.
UNIT - IV
Listening Comprehension: Listening to various accents, listening practice and exercises
UNIT - V
Group Discussions: Types of group discussions; case studies; dos and don'ts of group discussion-intensive practice.

Suggested Reading/Software:

1	T. Balasubramanian.A Textbook of English Phonetics for Indian Students. Macmillan,2008.
2	J. Sethi et al., A Practical Course in English Pronunciation (with CD). Prentice Hall of India, 2005.
3	Hari Mohan Prasad. How to Prepare for Group Discussions and Interviews. Tata McGraw Hill, 2006
4	English for Engineers and Technologists (Combined edition , Vol. 1 and 2) Orient Blackswan 2010.
5	**Software:** 1. Sky Pronunciation Suite 2. Study Skills 3. English Pronunciation Dictionary –CALD

ES 151CE	ENGINEERING GRAPHICS					
Pre-requisites	-		**L**	**T**	**P**	**C**
			2	-	4	4
Evaluation	**SEE**	50	**CIE**	25		

Course Objectives:	
1	Introduction to fundamentals and need of AUTOCAD software drawings
2	Knowledge about various 2D command of AUTOCAD drawing applicable for drawing and printing options.
3	Inputs on basic concepts of engineering drawing, lettering formats for analyzing various topics via, conic sections, invoutes.
4	Awareness towards the various types of projections and the drawings of 2D and 3D views.
5	Introduction to fundamentals and need of AUTOCAD software drawings

Course Outcomes	
CO-1	Knowledge on the fundamentals of AUTOCAD 2D commands
CO-2	Application of basic principles of drawing and scales for representation of prototype objects
CO-3	Relate the logic of projections to straight lines and various views of 2D and 3D objects
CO-4	Capability to imagine and project the developed surface and truncated portion of 3D solids
CO-5	Assimilation of visualization process to efficiently communicate ideas graphically and provide editable solutions

CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	2	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	-	2	2	-	2	-	2	-	-
CO3	2	2	1	-	-	-	2	2	-	2	-	2	-	-
CO4	2	2	1	-	-	-	2	2	-	2	-	2	-	-
CO5	2	2	2	-	-	-	2	2	-	2	-	2	-	-

Correlation rating : Low / Medium / High : 1 / 2 / 3 respectively.

UNIT - I

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.

UNIT - II

Overview of Computer Graphics covering, listing the computer technologies that impact on graphical communication, demonstrating knowledge of the theory of CAD software, Setting up of UNITs and drawing limits; ISO and ANSI standards for coordinate dimensioning, 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.

UNIT - III
Commands, initial settings, drawing aids, Drawing basic entities, Modify commands, Text and Dimensioning, Blocks Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing Options

UNIT - IV
Scales – Reduced and Enlarged scales, representative fraction, Plain, Diagonal and Vernier Scales, Projections of Points – placed in different quadrants, Projection of straight lines parallel to one plane, perpendicular to one plane, inclined to one plane and lines inclined to both planes.

UNIT - V
Projections of Planes – Projections when parallel to one plane, perpendicular to one plane, inclined to one plane and inclined to both planes. Projections of Regular Solids – Projections covering those parallel to one plane, perpendicular to one plane, inclined to one plane and inclined to both planes. Sections of Solids - sectional Views of Right regular solids covering Prism, Cylinder, Pyramid, and Cone Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone.

Suggested Text/Reference Books:	
1	Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2	Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3	Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4	Jeyapoovan T. (2015). Engineering Graphics Using Autocad, Vikas Publishing House Pvt. Ltd., Noida, 7th Edition
5	S.N. Lal., Engineering Drawing (2018), M/S. Cengage Learning India Pvt. Ltd., Pratap Gunj, Delhi

ES 152 ME	WORKSHOP PRACTICE					
Pre-requisites	-		**L**	**T**	**P**	**C**
			-	-	6	3
Evaluation	**SEE**	50	**CIE**	25		

Course Objectives:	
1	To learn about different tools used in workshop.
2	To understand the different manufacturing processes.
3	To learn about fabrication of components using different materials.

Course Outcomes: Upon completion of this laboratory course, students will be able to	
CO-1	Study and practice on tools and their operations of different trades.
CO-2	Practice on manufacturing of components using workshop trades including carpentry, fitting, foundry, smithy, sheet metal & welding
CO-3	Select suitable tools form a chining process including facing, turning & knurling
CO-4	Attain basic electrical knowledge for house wiring practice

SNO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3				3				1	1		1	1	
CO2	3				3				1	1		1	1	
CO3	3				3				1	1		1	1	
CO4	3				3				1	1		1	1	

LIST OF EXPERIMENTS:

1. **Carpentry shop**
   - Making of Cross lap joint with Wood
   - Making of EndLap/TeeLap Joint with wood
2. **Fitting shop**
   - Making of Step cut with Mild Steel flat
   - Making of semi circular and V-cutwith Mild Steel flat
3. **Sheet metal shop**
   - Making of Funnel with GI Sheet
   - Making of Rectangular box with GI Sheet
4. **House wiring**
   - Making of Cleat wiring
   - Making of casing wiring
5. **Welding shop**
   - Making of Butt joint using Arc Welding
   - Making of Lap Joint using Arc Welding

6. Machine shop
• Making of Step turning on MScylindricalrod
• Making of TaperturningonMScylindricalrod
7. Foundry shop
• Preparation of casting using single piecepattern
• Preparation of casting using corepattern
8. Smithy shop
• Forging of square shape peg from cylindrical workpiece
• Forging of squareshape L- bend pegfrom cylindrical workpiece

Suggested Text/Reference Books:
Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.

SEMESTER WISE SCHEMA WITH CREDITS

Scheme of Instruction for BE (Mining Engineering) - II Semester

S.No	Course Code	Course Title	Scheme of Instruction			Cont.Hrs/ Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
THEORY										
1	BS201MT	Engineering Mathematics-II	3	-	-	3	3	40	60	3
2	BS202PH	Engineering Physics	3	-	-	3	3	40	60	3
3	ES201CS	Computer Programming for Problem Solving	3	-	-	3	3	40	60	3
4	PC201MN	Introduction To Mining Engineering	3	-	-	3	3	40	60	3
5	ES 101 EE	Basic Electrical Engineering	3	-	-	3	3	40	60	3
PRACTICALS										
6	BS 252 PH	Engineering Physics Lab	-	-	2	2	3	25	50	1.5
7	ES 251CS	Computer Programming for Problem Solving Lab	-	-	2	2	3	25	50	1
8	ES251MN	Machine Drawing Practice	2	-	4	6	3	25	50	4
		Total	**17**	**00**	**08**	**25**	**24**	**275**	**450**	**21.5**
* At the end of II semester students should undergo Internship-I (UG Mines). Marks will award in III semester.										

L : Lectures
T : Tutorials
P : Practical
Dr. : Drawing
CIE : Continuous Internal Evaluation
SEE : Semester End Examination

BS 201 MT	ENGINEERINGMATHEMATICS–II (Common to all Branches)				
Pre-requisites	Mathematical Knowledge at Pre Universities Level	**L**	**T**	**P**	**C**
		3	-	-	3
Evaluation	**SEE** 60 Marks	**CIE**		40 Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1	To Study Matrix Algebra and its use in Solving System of Linear Equations and Solving Eigen Value Problems
2	To Study the First Order Linear and Non-Linear Ordinary Differential Equations
3	To Study the Higher Order Linear Ordinary Differential Equations with Variable and Constant Coefficients
4	To Introduce the Concept of Functions of Complex Variable and their Properties
5	To Study the Values of Improper Integers Using Residue Theorem.

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Solve System of Linear Equations and Eigen Value Problems
CO-2	Find the Solution of First Order Ordinary Differential Equations
CO-3	Identify the Solution of Higher Order Ordinary Differential Equations
CO-4	Determine the Analyticity and Integrals of Complex Functions
CO-5	Evaluate Complex and Real Integrals Using Residue Theorem

Articulation matrix of Course outcomes with PO's:

Subject: Engineering Mathematics II

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 1 0	PO 1 1	PO 1 2	PSO 1	PSO 2
CO 1	3	2	2	1	1	2	-	-	1	-	-	2	-	-
CO 2	3	2	1	2	2	1	-	-	1	-	-	2	-	-
CO 3	3	2	3	1	1	2	-	-	2	-	-	2	-	-
CO 4	3	2	1	2	1	2	-	-	1	-	-	2	-	-
CO 5	3	2	2	1	2	1	-	-	1	-	-	2	-	-

Correlation rating: Low/Medium/High: 1/2/3respectively.

UNIT–I
Matrices: Elementary row and column operations, Rank of a matrix, Echelon form, System of linear equations, Linearly dependence and independence of vectors, Linear transformation, Orthogonal transformation, Eigen values, Eigenvectors, Properties of Eigen values, Cayley-Hamilton theorem, Quadratic forms, Diagonalization of Matrices, Reduction of quadratic form to canonical form by orthogonal transformation, Nature of quadratic forms.

UNIT- II
First Order Ordinary Differential Equations: Exact First Order Differential Equations, Integrating factors, Linear First Order Equations, Bernoulli's, Riccati's and Clairaut's Differential Equations, Orthogonal Trajectories of a given family of curves.

UNIT- III
Differential Equations of Higher Orders : Linear Independence and Dependence, Solutions of Second and Higher Order Linear Homogeneous Equations with Constants Coefficients, Method of Reduction of order for the Linear Homogeneous Second Order Differential Equations with Variable Coefficients , Solutions of Non- Homogeneous Linear Differential Equations, Method of Variation of Parameters, Solution of Euler-Cauchy Equation, Simultaneous Linear Differential Equations.

UNIT- IV
Functions of a Complex Variable: Limits and Continuity of a Function, Differentiability and Analyticity, Elementary Analytic Functions, Necessary and Sufficient Conditions for a Function to be Analytic, Cauchy-Riemann Equations in Polar form, Harmonic Functions, Complex Integration, Cauchy's Integral Theorem, ExtensionofCauchy'sIntegralTheoremformultiplyconnectedregions,Cauchy'sIntegral Formula, Cauchy's Formula for Derivatives.

UNIT-V
Residue Calculus: Power Series, Taylor's Series, Laurent's Series, Zeros and Singularities, Residues, Residue Theorem, Evaluation of Real Integrals Using Residue Theorem, Bilinear Transformations (All Theorems without Proof).

Suggested Readings:

1	R. K. Jain & S.R.K Iyengar, Advanced Engineering Mathematics, Narosa Publications, 4th Edition 2014 (Text Book).
2	Erwin Kreyszi, Advanced Engineering Mathematics, John Wiley, 9th Edition, 2012.
3	B.S. Grewal, Higher Engineering Mathematics, Khanna Publications, 43rd Edition, 2014.
4	Dr.M.D. Raisinghania,*OrdinaryandPartialDifferentialEquations*,S.CHAND,17thEdition2014
5	JamesBrown,R.VChurchill,*ComplexVariablesandapplications*,McGrawHill9thEdition2013
6	N.P. Bali and M.Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2010.
7	H.K. Dass, Er. Rajnish Varma, higher Engineering Mathematics, S.Chand Technical 3rd Edition.

BS 201 PH	ENGINEERING PHYSICS					
	(Basic Science)					
Pre-requisites			L	T	P	C
			3	-	-	3
Evaluation	SEE	60 Marks	CIE		40 Marks	

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1	understand the basic concepts of Waves, Oscillations and Acoustics.
2	understand the different types Magnetic materials and Dielectric materials with their origin of evolution.
3	understand the formation of energy bands and classification of the solids based on the band theory. To understand the concept of semiconductors, ultrasonic and its wide applications.
4	understand implications of basic laws of electricity and magnetism to know the significance of techniques of Modern Optics.
5	sensitize towards nanomaterial and appraise the various characterization techniques.

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	enrich and understand concepts and real time applications of waves, acoustics and ultrasonic properties.
CO-2	apply the dielectric properties, magnetic properties, semiconducting properties of materials.
CO-3	analyze basics laws of electricity, magnetism and concepts of modern optics.
CO-4	evaluate the different material characterization techniques.
CO-5	appreciate significance of nanomaterials and create desired properties by using various methods of synthesis processes.

Course outcome	Program Outcome											
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO-1	3		2		2	1						
CO-2	3	3	1	1	3	1						
CO-3	3	2	1	1	2	2						
CO-4	3		3	1	2	1	1					
CO-5	3	2	1	2	3	3						

UNIT – I
Oscillations in Physical Systems: Simple harmonic oscillations–Damped harmonic oscillator – Heavy, critical and light damping – Energy decay in a damped harmonic oscillator – Quality factor – Forced oscillators – Resonance – forced oscillator and LCR circuit analogy.
Acoustics: Classification of sounds- Sound intensity level, Reverberation, Reverberation time- - Absorption coefficient – Sabine's formula for reverberation time – Factors effecting Acoustics of building and their remedies.

UNIT – II
Dielectric Materials: Dielectrics - Types of polarizations – Electronic, Ionic, Orientation and Space charge polarizations – Expression for Electronic polarizability - Frequency and temperature dependence of dielectric polarizations - Determination of dielectric constant by capacitance Bridge method - Ferro electricity - Barium Titanate - Applications of Ferroelectrics.
Magnetic Materials: Origin of magnetism (Orbital and Spin magnetic moments) - Classification of magnetic materials: dia, para, ferro, antiferro and ferromagnetic materials – Weiss molecular field theory of ferromagnetism - Magnetic domains - Hysteresis curve - Soft and hard magnetic materials – Ferrites: Applications of ferrites.

UNIT – III
Semiconductor Physics: Classification of materials based on band theory. Kronig - Penney model (qualitative treatment) - Energy band formation in solids - Intrinsic and Extrinsic semiconductors - Concept of a hole - Carrier concentration and conductivity in intrinsic semiconductors – Formation of P-N junction diode, Zener diode, Light Emitting Diode and their I-V characteristics – Thermistor and its characteristics - Hall effect and its applications.
Ultrasonic: Introduction to Ultrasonic waves - Properties of Ultrasonic - Production of ultrasonic waves by converse Piezoelectric method – Detection of ultrasonic waves - Piezoelectric detector — Wavelength of Ultrasonic by Debye-Sears method (Liquid grating) – Applications.

UNIT – IV
Electromagnetic theory: Basic laws of electricity and magnetism - Maxwell's equations in integral and differential forms - Conduction and displacement current – Relation between Displacement current (**D),** Electric Intensity (**E)** and Polarization (**P)** - Electromagnetic waves: Equation of plane wave in free space – Pointing theorem.
Modern Optics: Interference – Newton's Rings by reflected light – Experimental arrangement – Types of diffraction – diffraction grating (Conditions of maxima and minima) – Resolving power of grating –Types of polarized light – Polarization by reflection – Malus law – Double refraction – Nicol's Prism. – Optical activity and polarimeter.

UNIT – V
Nanomaterials: Introduction - Properties of materials at reduced size - Surface to volume ratio – Quantum confinement effect–Classification of nanomaterials - Preparation of nanomaterials: bottom–up methods (e.g., Sol Gel method and Chemical Vapour Deposition method), Top-down methods (e.g., Ball milling method) - Basic ideas of carbon nanotubes – Applications of nanomaterials and their health hazards.
Techniques for Characterization: Morphological studies of materials – X-ray Diffraction(XRD), Scanning Electron Microscopy (SEM). Spectroscopic studies of materials – Fourier Transform Infrared (FTIR), Beer's law, UV-Visible and Raman spectroscopy.

Suggested Reading:

1	M.S. Avadhanulu and P.G. Kshirasagar - Engg. Physics, S.Chand& Co.
2	C.M. Srivastava and C. Srinivasan - Science of Engg. Materials, New AgeInternational.
3	R.K. Gour and S.L. Gupta – Engg. Physics, Dhanpat Rai Publications.
4	B.K. Pandey and S.Chaturvedi – Engineering Physics, Cengage Learning.
5	A.K Bhandhopadhya - Nano Materials, New Age International.
6	S.K. Sharma, et al., Hand book of Material Characterization – Springer.

ES 201 CS	COMPUTER PROGRAMMING FOR PROBLEM SOLVING					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

	Course Objectives:
1	To introduce the basic concepts of Computing environment, number systems and flowcharts
2	To familiarize the basic constructs of C language – data types, operators and expressions
3	To understand modular and structured programming constructs in C
4	To learn the usage of structured data types and memory management using pointers
5	To learn the concepts of data handling using files

Course Outcomes :	
On completion of this course, the student will be able to implement	
CO-1	Explain various functional components in computing environment
CO-2	Develop algorithmic solutions to problems and draw the flow charts
CO-3	Explain and use basic constructs of C in writing simple programs
CO-4	Use standard library functions in C and develop modular programs using user defined functions and structured data types

UNIT – I

Introduction to Computers: Computer Systems, Computing Environments, Computer Languages, Creating and Running Programs, Software Development, Flow charts.
Number Systems: Binary, Octal, Decimal, Hexadecimal
Introduction to C Language - Background, C Programs, Identifiers, Data Types, Variables, Constants, Input / Output Statements Arithmetic Operators and Expressions: Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions.

UNIT - II

Conditional Control Statements: Bitwise Operators, Relational and Logical Operators, If, If-Else, Switch-Statement and Examples. Loop Control Statements: For, While, Do-While and Examples. Continue, Break and Goto statements.
Functions: Function Basics, User-defined Functions, Inter Function Communication, Standard Functions, Methods of Parameter Passing.
Recursion- Recursive Functions.
Storage Classes: Auto, Register, Static, Extern, Scope Rules, and Type Qualifiers.

UNIT – III

Pre-processors: Pre-processor Commands
Arrays - Concepts, Using Arrays in C, Inter-Function Communication, Array Applications, Two-Dimensional Arrays, Multidimensional Arrays, Linear and Binary Search, Selection and Bubble Sort.

UNIT - IV
Pointers - Introduction, Pointers for Inter-Function Communication, Pointers to Pointers, Compatibility, L value and R value, Arrays and Pointers, Pointer Arithmetic and Arrays, Passing an Array to a Function, Memory Allocation Functions, Array of Pointers, Programming Applications, Pointers to void, Pointers to Functions, Command-line Arguments. **Strings -** Concepts, C Strings, String Input/output Functions, Arrays of Strings, String Manipulation Functions.

UNIT - V
Structures: Definition and Initialization of Structures, Accessing Structures, Nested Structures, Arrays of Structures, Structures and Functions, Pointers to Structures, Self-Referential Structures, Unions, Type Definition (typedef), Enumerated Types. **Input and Output:** Introduction to Files, Modes of Files, Streams, Standard Library Input/Output Functions, Character Input/ Output Functions.

References:	
1	B.A. Forouzan and R.F. Gilberg, "*A StructuredProgramming Approach in C",*Cengage Learning, 2007
2	Kernighan BW and Ritchie DM, "*The C Programming Language"*, 2nd Edition, Prentice Hall of India, 2006.
3	Rajaraman V, "*The Fundamentals of Computer"*, 4th Edition, Prentice-Hall of India, 2006.
4	Dromey, How to solve it by Computer, Pearson Education, 2006

PC 201 MN	INTRODUCTION TO MINING ENGINEERING					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Objective of the Course:	
1	To make the students aware of Mining industry, mineral resources, and UNIT operations in mining, different mining methods

Outcomes of the course:	
CO-1	After the completion of the course, student is expected to have skills in:
CO-2	Understanding of Mining Industry, mineral resources available in the world.
CO-3	Understanding of different UNIT operations in mining.
CO-4	Understanding of different mining methods used for extraction of coal and metal mineral.
CO-5	Understanding of mine safety aspects.

UNIT - I :

Introduction to Indian Mining Industry: Introduction to Indian Mining Industry, National and International Scenario. Indian mineral resources and world status. Classification of mineral deposits.

UNIT- II :

Introduction to Drilling and Blasting: Exploratory Drilling, Fundamentals of explosive and blasting techniques, Accessories of blasting, Safety aspects in Drilling and Blasting.

UNIT -III

Excavation & Transportation: Safety aspects in Excavations. Various transportation systems in UG Mines. Different types of equipment's used in surface and underground mining projects.

UNIT -IV

Underground Mining & Opencast Mining (Coal & Metal): Definition of various terms associated with mining operations. Brief about mine entries: shafts, incline, and adit.

UNIT- V

Introduction to Mine Safety and Statutory provisions: Introduction to Mine Safety, Environmental Impacts, Brief about various statutory provisions.

Suggested Text Books:

1	Deshmukh, D. J., Elements of Mining Technology, Vol. I, 1994
2	Hartman H.L., Introductory Mining Engineering, Wiley Inter science, New York, 1987.
3	Mishra, G.B, Surface Mining Dhanbad Publishers, Dhanbad, 1994.
4	SK Das, Surface Mining Technology, 2008
5	Deshmukh, D. J., Elements of Mining Technology, Vol. II, 1994

ES 101 EE	BASIC ELECTRICAL ENGINEERING					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives	
1	To understand the fundamentals of DC and AC electrical circuits.
2	To understand the working principles of DC motor, DC generator, Transformers and single phase induction motors.
3	To understand working principles of protection devices used in electrical circuits.
4	To understand the fundamentals of DC and AC electrical circuits.
5	To familiarize the design and working principles of Single-phase induction motor & DC Machines.

Course Outcomes	
CO-1	Analyze the performance of simple electrical circuits exciting with DC and AC excitations.
CO-2	Apply different theorems to solve complicated electrical circuits to obtain the current, voltage and power.
CO-3	Understand the main components, Characteristics, applications of different DC and AC electrical machines used in industry.
CO-4	Understand the importance of protective devices and their rating used in electrical circuits.
CO-5	Understand the importance of Single-phase induction motor & DC Machines, Electrical Installations

UNIT-I

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

UNIT-II

AC Circuits: 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, and RL, RC, RLC combinations (series only). Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III

Transformers and 3-ph Induction Motors: Transformers: Electromagnetic induction, Faradays laws, Statically induced EMF, Lenz law, BH characteristics, ideal and practical transformer, losses and efficiency, Auto-transformer and three-phase transformer connections. Three Phase Induction motor: Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, squirrel cage IM, slip-ring IM, Applications With effect from the Academic year 2018-2019.

UNIT-IV
Single-phase induction motor & DC Machines: Single-phase induction motor: Construction and principle of operation, Capacitor start & capacitor run motor, applications DC Generators: Dynamically induced EMF, Flemming's Right hand and Left hand rules, Construction and principle of operation of DC generator, EMF equation, Types of DC Generators, OCC characteristics, applications DC Motors: principle of operation of DC Motor, Types of DC motors, applications

UNIT-V
Electrical Installations: 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	J.B. Gupta, "Fundamentals of Electrical Engineering and Electronics" S.K. Kataria & Sons Publications, 2002.
2	J.B.Gupta, "Utilization of Electric Power and Electric Traction" S.K. Kataria &Sons Publications, 2010
3	Abhijit Chakrabarti, Sudipta Nath, Chandan Kumar Chanda, "Basic Elactrical Engineering" Tata McGraw Hill, Publications, 2009
4	Hughes, "Electrical Technology", VII Edition, International Student -on, Addison Welsey Longman Inc., 1995.

BS 252 PH	ENGINEERING PHYSICS LAB					
	(Basic Science)					
Pre-requisites	Strength of Materials		**L**	**T**	**P**	**C**
			-	-	2	1.5
Evaluation	**SEE**	50 Marks	**CIE**		25 Marks	

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1	demonstrate an ability to make physical measurements and understand the limits of precision in measurements.
2	demonstrate the ability to use experimental statistics to determine the precision of a series of measurements.
3	demonstrate the ability to understand optical / Semiconducting / dielectric properties of materials.
4	demonstrate the ability to understand the construction and working of different experiments.

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	recognize the transformation concepts into practicals. .
CO-2	use a best fit to create a graph from a series of data points. Students can extrapolate and interpolate.
CO-3	appreciate the mathematical abilities to meaningful physical conclusions.
CO-4	develop skills to impart practical knowledge in real time solution and learn to design new instruments with practical knowledge.
CO-5	understand the link between theory and practicals.

Course outcome	**Program Outcome**											
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	3	3										
CO-2	3	3	1									
CO-3	3	3	3									
CO-4	3	3	2	1	3	1						
CO-5	3	1										

Correlation rating : Low / Medium / High : 1 / 2 / 3 respectively.

Experiment - I
To determine the Dielectric constant and Phase transition temperature of Lead Zirconium Titanate (PZT).

Experiment - II
Determination of Velocity of ultrasonic waves in a given liquid by Debye-Sears method.

Experiment - III
To draw the I-V Characteristics of P-N Junction diode and to evaluate the value of potential barrier of the diode.

Experiment - IV
To find the values of Electrical conductivity and energy gap of Ge crystal by Four probe method.

Experiment - V
Determination of rigidity of modulus of Torsion pendulum.

Experiment - VI
To study V-I characteristics of Light Emitting Diode.
Experiment - VII
Determination of carrier concentration, Mobility and Hall Coefficient of Ge Crystal using Hall Effect Experiment.

Experiment - VIII
Verification of Beer's law.

Experiment - IX
To Estimate Radius of curvature of given lens by forming Newton's rings.

Experiment –X
To determine resolving power of plane grating.

Experiment - XI
To determine the constants of A, B and α of given Thermistor.

Experiment - XII
To determine specific rotatory power of a given solution by using Laurent's Half shade polarimeter.

ES 251CS	COMPUTER PROGRAMMING FOR PROBLEM SOLVING LAB (Common to all Branches)					
Pre-requisites			**L**	**T**	**P**	**C**
			-	-	2	1
Evaluation	**SEE**	50 Marks	**CIE**		25 Marks	

	Course Objectives:
1	To use tools available under LINUX for C programming
2	To gain hands-on experience on basic constructs of C programming
3	To formulate problems and implement algorithmic solutions in C
4	To write modular programs in C using structure programming techniques and data files

.

Course Outcomes: Student will be able to:	
CO-1	Write, compile and debug C programs in Linux environment
CO-2	Write simple programs using control structures, user defined functions and data manipulation using arrays
CO-3	Use standard C library functions to develop modular programs in C

List of experiments:	
1	Introducing to programming Environment (Linux commands, editing tools such as vi editor, sample program entry, compilation and execution)
2	Write programs using arithmetic, logical, bitwise and ternary operators.
3	Write programs simple control statements: Roots of a Quadratic Equation, extracting digits of integers, reversing digits, finding sum of digit ,printing multiplication tables, Armstrong numbers, checking for prime, magic number,
4	Sin x and Cos x values using series expansion
5	Conversion of Binary to Decimal, Octal, Hexa and Vice versa
6	Generating a Pascal triangle and Pyramid of numbers
7	Recursion: Factorial, Fibonacci, GCD
8	Finding the maximum, minimum, average and standard deviation of given set of numbers using arrays
9	Reversing an array, removal of duplicates from array
10	Matrix addition, multiplication and transpose of a square matrix. using functions
11	Bubble Sort, Selection Sort,
12	Programs on Linear Search and Binary Search using recursion and iteration
13	Functions of string manipulation**:** inputting and outputting string, using string functions such as strlen( ), strcat( ), strcpy( ) ..... etc
14	Writing simple programs for strings without using string functions.
15	Finding the No. of characters, words and lines of given text file
16	File handling programs: student memo printing
17	Create linked list, traverse a linked list, insert a node, delete a node, reversing list.

For online practice problems: https://projecteuler.net

ES 251 MN	MACHINE DRAWING PRACTICE					
Pre-requisites			**L**	**T**	**P**	**C**
			2	-	4	4
Evaluation	**SEE**	50 Marks	**CIE**		25 Marks	

Course Objectives:	
1	To understand format of drawing sheet, angle of projections, isometric projections, sectional views and practice on simple machine elements
2	To practice sketching of standard machine elements
3	To have knowledge on ISO system of Limits and Fits
4	To understand assembly drawings of typical machine parts such as Connecting rod, Eccentric, Cross head, Machine vice, Screw jack, Bearings, Tail stock etc.

Course Outcomes: At the end of the course students will be able to	
CO-1	Will be able to draw isometric and orthogonal projections and sectional views of various mechanical components
CO-2	Will be able to draw free hand sketches of various mechanical components
CO-3	Will be able to understand the shape and structure of different types of joints, screws, keys and Couplings
CO-4	Will be sufficiently knowledgeable to produce assembly views of various machines components from part drawings
CO-5	Will be able to read and have preliminary understanding of the industrial drawings.

UNIT-I

Standard Drawing Practices: Format of drawing sheet, title block, conventions of drawing lines and dimensions.
Abbreviated indication of standard parts in assembly drawings. First and third angle projections, views of simple machine elements from the given pictorial and orthographic views.

UNIT II

Machine Drawing Conventions: Need for Machine Drawings –Introduction to types of Drawings and working Drawings for Machine Parts.
a) Types of Sections – Selection of sectional planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.
b) Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centre lines, curved and tapered features.
c) Title boxes - size, location and details - common abbreviations in general usage

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UNIT-III

Drawing of Machine Elements and Simple Parts: Selection of Views, additional views for the following machine elements and parts with easy drawing proportions.
a) Screw Threads and Fasteners - Popular forms of Screw Threads, Bolts, Nuts, Stud Bolts, Tap Bolts, Set Screws.
b) Keys – Saddle Keys, Sunk Keys, Feather Keys, Woodruff Keys, Splines
c) Cotter Joints – with Sleeves, with Socket and Spigot ends, with Gibs
d) Pin Joints – Knuckle Joint.
e) Riveted Joints: Various types of Riveted Joints for plates.

f) Welded Joints: Various types of Welded Joints and symbols.
g) Shaft coupling – Sleeve or Muff Couplings, Flanged Couplings, Universal Couplings, Oldham Coupling.
h) Pipe Joints: Cast Iron Pipe Joints, Joints for Hydraulic Pipes, Pipe Fittings
i) Pulleys: Flat Belt Pulleys, 'V' – Belt Pulleys, Rope Pulleys. 67
j) Bearings: Journal Bearings – Solid, Bushed and Collared Journal Bearings, Pivot or Foot-Step Bearings.

UNIT-IV

Assembly Drawings (Engine Parts): Drawings of Assembled Views for the part drawings of the following using conventions and easy drawing proportions.

Engine Parts: Steam Engines: Stuffing Box, Cross Head, Eccentric. Petrol Engine: Connecting Rod, Piston Assembly.

UNIT V

Other Machine Parts Assembly Drawings (Valves parts): Drawings of Assembled Views for other parts drawings of the following using conventions and easy drawing proportions.

Valves Parts: Gate Valve, Screw-down Stop Valve, Spring Loaded Safety / Relief Valve, Feed Check Valve and Aircock.

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Pattern of Exam:
Internals: Conventional and CAD Software
Externals: Conventional
N.B. Tolerance charts to be provided in the examination Hall for calculation of limits.

Suggested Reading:	
1	Siddeshwar N, Kannaiah P and Sastry VVS, "*Machine Drawing*", Tata McGraw Hill Publishing Co. Ltd., 5th Edition, 1994.
2	Bhatt N.D, "*Machine Drawing*", Charotar Publishing House, Anand, New Delhi, 28th Edition, 1993. Machine Drawing: N.D. Bhatt; Charotar Publications, 47th Edition,2012
3	Narayan K.L, Kannaiah P, Venkat Reddy K, "*Machine Drawing*", New Age International (P) Ltd., 2nd Edition, 1999. Machine Drawing: K. L. Narayana, P. Kannaiah & K. Venkata Reddy; New Age Publishers, 5th Edition, 2016.
4	K. C. John, "*Text book of Machine Drawing*", PHI Learning, 2010.
5	P. Narsimha Reddy, T.A. Janardhan Reddy, C.S. Rao, *Production Drawing Practice*, High Tech Publishers, 2001.
6	R.K. Jain, *Engineering Metrology*, Khanna Publishers, 8th Ed. 1985.
7	K.L. Narayana, P. Kannayya and K. Venkat Reddy, *Production Drawing*, New Age International (p) Ltd. Revised edition, 1997.
8	The Solid Works software manual
Reference Books:	Ajeet Singh, "Machine Drawing", TMH Publications, 4th Edition, 2010. P. S. Gill, "Machine Drawing", Kataria Publications, 16th Edition, 1996. Junarkar. N. D, "Machine Drawing", Pearson Publication, 2009
E - Resources:	1. https://rb.gy/eln9yk 2. https://rb.gy/p9q0o0 3. https://rb.gy/erlhm8

PW 921MN	**INTERNSHIP- I***					
Pre-requisites			**L**	**T**	**P**	**C**
			-	-	-	2
Evaluation	**SEE**	--	**CIE**		50 Marks	

Course Objectives:	
1	To expose the students in understanding the real-life practical problems and technologies.
2	To provide an opportunity to integrate various aspects of learning reference of practical problems.
3	To enhance the confidence of the students by interaction with field professionals

Course Outcomes: Student will be	
CO-1	Able to complete the task or realize a pre specified target within a limited scope.
CO-2	Able to learn to find alternate viable solutions for a given problem based on criteria.
CO-3	Ability to learn field constraints and also documentation of technical report.

Summer Internship is introduced as part of the curricula to encourage students to work on problems of interest to industries or in a consulting organization. A batch of two or three students will be attached to Underground projects in Mining Industry for a period of two weeks. This will be during the vacation followed after the completion III semester course. Faculty member (s) will be acting as an internal guide(s) for the batches to mentor and monitor the progress and also interacts with the industry guide (s) as per the need.

After the completion of the internship, students need to submit a brief technical report on the project executed and present the work through a seminar talk to be organized by the Department. Award of sessional are based on the performance of the student at the work place and will be judged by internal guide (s) (25 Marks) followed by presentation before the committee constituted by the Department (25 Marks). One faculty member will coordinate the overall activity of Summer Internship.

***Students have to undergo internship of 2 Weeks duration at the end of semester III (during vacations) and the credits will be awarded after evaluation in IV semester.**