



SYLLABI OF BASE MODULE (Technology)

(Revised and approved by the 24th Academic Council Meeting, held on 6th May, 2017)



NORTH EASTERN REGIONAL INSTITUTE OF SCIENCE & TECHNOLOGY

DEEMED TO BE UNIVERSITY U/S 3 OF THE UGC ACT, 1956

Nirjuli (Itanagar), Arunachal Pradesh - 791 109

REVISED SYLLABUS

FOR

BASE MODULE PROGRAMME

(Syllabi of U.G programme has been revised and approved in the 24th Academic Council Meeting, 2017)



North Eastern Regional Institute of Science and Technology

**Deemed to be University
Nirjuli Arunachal Pradesh, 791109**

2017

PREFACE

The syllabi of U.G programme has been revised and approved in the 24th Academic Council Meeting, 2017. The academic programme of NERIST in Technology stream has been designed to consist of three modules i.e Base (Certificate), Diploma and Degree Modules. In applied Science Stream four years Degree Module is offered.

The syllabi for Base, Diploma and Degree programmes of NERIST are unique and innovative and have been prepared by the faculty of the Institute keeping the requirement of AICTE, UGC and ICFRE guidelines in mind.

At the Base (Certificate) Level, the prime emphasis is on Vocation with additional training being imparted in basic science, inter-disciplinary and preparatory courses for enabling the students to take up further studies.

The following norms have been followed in presenting the structures and contents.

COURSE CODE:

Courses are denoted by coded comprising two letters and four digits. The letters indicate the Department which is offering the courses. The digit represents the following:

- i. The first digit from the left stand for the year.
- ii. The second digit **1** or **2** from the left stands for the odd or even semester respectively for the regular courses.
- iii. The second digit **3** or **4** from the left stands for the odd or even semester respectively for the bridge courses at the degree level.
- iv. The third and the fourth digits from the left is used for course number of which **00** to **49** are of theory or courses with more theory component and **50** to **99** are for practice or courses with more practice components.

Besides the following course codes are specifically reserved:

Y299 - Project.

6266 - Study Tour.

6199 - Industrial Tour.

YS77 - Audit Course.

Y288 - Extra Curricular Activities and discipline grades.

"**Y**" stands for years and "**S**" for Semester.

COURSE CREDITS:

Lecture/Tutorial: One Hour per week per semester is equivalent to one credit. Extra tutorials, whenever applicable do not carry any credits.

Practice: Two hours per week per semester is equivalent to one credit. If the number of practice hour is an odd number and more than one, then the credits equivalent to the next higher even number of hours will be assigned. For example, 3 hours of practice will carry 2 credits, 5 hours carries 3 credits and so on.

UNITIZATION:

The course has been unitized with the number of units ranging from IV to VI, depending upon the credit of the course, coverage required and the nature of the course. Each unit has been assigned specific number of contact hours, which has been fixed @14 contact hours per lecture credit of the course.

Recommended Books:

Suggestions on the recommended books have been given at the end of each course, which may be supplanted by the Course Coordinator, if required, while offering the Course.

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Department of Agricultural Engineering

Programme: Certificate in Agricultural Engineering

Year I						
Semester I						
S.N.	Course Code	Course Title	L	T	P	Credits
1	HS1101	Remedial English – I	2	0	2	03
2	PH1101	Physics – I	4	0	2	05
3	CY1101	Chemistry – I	3	0	2	04
4	MA1101	Mathematics – I	3	1	0	04
5	ES1151	Engineering Drawing	0	0	6	03
6	ES1152	Workshop Practice	0	0	8	04
		Total	12	1	20	23
Semester II						
S.N.	Course Code	Course Title	L	T	P	Credits
1	HS1201	Remedial English - II	2	0	2	03
2	PH1201	Physics – II	4	0	2	05
3	CY1201	Chemistry – II	3	0	2	04
4	MA1201	Mathematics – II	3	1	0	04
5	ES1200	Basic Electrical & Electronics Engineering	4	0	2	05
6	ME1251	Mechanical Drawing	1	0	4	03
		Total	17	1	12	24
Year II						
Semester I						
S.N.	Course Code	Course Title	L	T	P	Credits
1	MA2101	Mathematics – III	3	1	0	04
2	AE2100	Mechanical Servicing and Maintenance	3	0	3	05
(A) Tractor Mechanic Trade						
3	AE2151	Introduction to Tractor	1	0	4	03
4	AE2101	Engine Systems	2	0	4	04
5	ME2121	Machine Shop Theory and Practice	2	0	4	04
6	AE2102	Land Reclamation Machinery	2	0	2	03
		Total	13	1	17	23
(B) Food Processing Trade						
S.N.	Course Code	Course Title	L	T	P	Credits
3	AE2103	Basics of Food	3	0	2	04
4	AE2104	Principles of Food Engineering	2	0	3	04
5	AE2105	Food Process	2	0	3	04
6	AE2152	Food Processing Plant Practice	1	0	5	04
		Total	14	1	16	25
		For Tractor Mechanic Trade				23
		For Food Processing Trade				25
Semester II						
S.N.	Course Code	Course Title	L	T	P	Credits
1	ES2201	Technical Mechanics	3	1	0	04
2	ES2200	Basics of Computer and Programming	2	0	2	03
3	HS2201	Entrepreneurship	3	0	0	03
4	ED2288	Extra-Curricular Activities	0	0	0	02
(A) Tractor Mechanic Trade						
5	AE2200	Farm Equipment and Maintenance	2	0	3	04
6	AE2201	Tractor Service Centre Management	2	1	0	03
7	AE2202	Tractor Systems	2	0	5	05
8	AE2251*	Vocational Training	-	-	-	02
		Total	14	2	10	26

(B) Food Processing Trade						
S.N.	Course Code	Course Title	L	T	P	Credits
5	AE2203	Fruits & Vegetables Processing	2	0	3	04
6	AE2204	Milk Processing	2	0	3	04
7	AE2205	Meat, Fish & Egg Processing	2	0	3	04
		Total	14	1	11	24
		For Tractor Mechanic Trade				26
		For Food Processing Trade				24

*Vocational training will be provided during winter break for 2 weeks

COURSE CONTENTS

AE2100 Mechanical Servicing and Maintenance: 5 Credits (3-0-3)

Unit 1	Introduction to general mechanical hand and power tools used in Fitting, Sheet Metal, Carpentry, Forging shop, Foundry shop, and Automobile workshop.	10 lectures
Unit 2	Introduction to machine components like Fasteners, Bearing, Coupling, Spring, Belt drive etc. Common defects in machine components, their servicing, and remedial procedure. Seals and packaging.	12 lectures
Unit 3	Lubrication and lubricants. Introduction to some engineering materials like MS, CI, Al, Cu etc. and their alloys. Material hardening and electroplating.	12 lectures
Unit 4	Introduction to preventive maintenance, defects and the corrective steps. Servicing and maintenance of mechanical, electrical, hydraulic and pneumatic systems.	8 lectures

Recommended Books:

- 1 Industrial Maintenance, H.P.Garg, S. Chand and Co., New Delhi, 1997.
- 2 Machine Operation and Maintenance manual, Escorts Tractor Limited, Bangalore.
- 3 Elements of Workshop Technology, Vol.-I, S.K. Hajra Choudhury, A.K. HajraChoudhury and S.C. Bhattacharya, 10th Ed., Media Promoters and Publishers Pvt. Ltd., Mumbai, 1986.

AE2151 Introduction to Tractor: 3 Credits (1-0-4)

Unit 1	History of tractor, major tractor manufacturers in India, technical specifications of various types and models of tractors.	3 lectures
Unit 2	Use of tractor, difference between automobile and tractor, Safety features, Safety in tractor operation, Various controls (Hand and foot operated)	3 lectures
Unit 3	Tractor implement hitching system, Preparation of tractors for mobile and stationary farm operations including ballasting, fitting cage wheels, Adjustment of track width.	4 lectures
Unit 4	Introduction to PTO drive, Alignment of belt and pulley. General maintenance of tractor and power tiller.	4 lectures

Recommended Books:

- 1 Farm Tractor Maintenance and Repair, 4thEd., S.C. Jain and C.R. Rai, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1992.
- 2 Principles of Agricultural Engineering, Vol. – 1, 2ndEd., A.M. Michael and T.P. Ojha, Jain Brothers, New Delhi, 1987.
- 3 Diesel Machines, 3rd Ed. E.J. Schulz and B.L. Evridge, McGraw Hill International, New York, 1988.

AE2101 Engine Systems: 4 Credits (2-0-4)

Unit 1	Tractor engines: Components of engine, dismantling and assembling, checking of wear and tear, repair of worn out components.	12 lectures
Unit 2	Fuel, cooling, lubrication, air intake, exhaust system and their repair and maintenance.	8 lectures
Unit 3	Engine troubles, causes and their remedies: Failure of engine to start, low power and uneven running, excess oil consumption, engine overheating, pre-ignition etc.,	4 lectures
Unit 4	Engine overhauling: tools and methods.	4 lectures

Recommended Books:

- 1 Farm Tractor Maintenance and Repair, 4th Ed., S.C. Jain and C.R. Rai, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1992.
- 2 Elements of Agricultural Engineering, 3rd Ed. J. Sahay, Agro Book Agency, Patna, 1992.
- 3 Diesel Machines, 3rd Ed., E.J. Schulz and B.L. Evridge, McGraw Hill International, New York, 1988.

AE2102 Land Reclamation Machinery: 3 Credits (2-0-2)

Unit 1	Hydraulic system: Components like pumps, valves, and cylinders etc., application, repair and maintenance of hydraulic system.	10 lectures
Unit 2	Crawler tractor: Differential, brake, clutch, suspension, track-assembly, and their repair and maintenance.	7 lectures
Unit 3	Introduction to bulldozer, front end loader, ditcher, excavator, land leveller, grader, roller and dump truck.	7 lectures
Unit 4	Trouble shooting of land reclamation machinery.	4 lectures

Recommended Books:

- 1 Land Reclamation Machinery, 1stEd. T. Borshchow, R. Mansurou and V. Sergeev, MIR Publication, Moscow, 1988.
- 2 Manual of Tractor, J. Konrod, Asia Publishing House, Delhi.
- 3 Motor Grader, E.G. Roninson, MIR Publication, Moscow, 1985.

AE2103 Basics of Food: 4 Credits (3-0-2)

Unit 1	Various foods and their characteristics.	10 lectures
Unit 2	Chemistry of food and food constituents, nutritive values of foods.	12 lectures
Unit 3	Browning reaction, food additives, adulteration, food laws etc.	9 lectures
Unit 4	Food microbiology and biochemistry.	11 lectures

Recommended Books :

- 1 Foods, Facts and Principles, N.S. Manay and M. Shadaksharaswamy, New Age International (P) Ltd., New Delhi., 1987.
- 2 Food Science, N.N. Potter, 5thEd., CBS Publisher and Distributors, Delhi, 1996.
- 3 Food Science, B. Srilakshmi, 5th Ed., New Age International (P) Ltd. New Delhi, 1997.
- 4 Hand Book of Food, M. Swaminathan, The Bangalore Print & Publishing Co. Ltd. Bangalore, 1988.

AE2104 Principles of Food Engineering : 4 Credits (2-0-3)

Unit 1	Introduction to heat transfer, fluid transfer and mass transfer in food processing.	6 lecture
Unit 2	Food preservation principle and methods. Thermal preservation of food and their machineries: Pasteurization, sterilization, UHT, canning. Irradiation, cooking and baking.	8 lecture
Unit 3	Evaporation, Drying and their machineries. Microwave and IR heating.	7 lecture
Unit 4	Freezing and Refrigeration in food processing and their machineries.	7 lecture

Recommended Books :

- 1 Fundamentals of Food Process Engineering, R.T. Toledo, 2nd Ed., CBS Publishers and Distributors, New Delhi, 1997.
- 2 Unit Operations in Chemical Engineering, McCabe, Smith and Harriot, 5th Ed., McGraw Hill Book Co., New York, 1993.
- 3 Transport Processes and Unit Operations, C.J. Geankopolis, 3rd Ed., Prentice Hall of India, New Delhi, 1999.
- 4 Food Engineering Operations, Brennan, Butters Cowell and Lilley, 3rd Ed., Elsevier Applied Science, Amsterdam, 1990.

AE2105 Food Process : 4 Credits (2-0-3)

Unit 1	Cleaning, sorting, grading and sieving in food processing and their machinery.	7 lecture
Unit 2	Size reduction and cutting operation in food processing and materials handling for food material.	7 lecture
Unit 3	Cereals, pulses and oil seed milling and their machinery. Fruits & vegetables processing machinery: steam jacket kettle, juicer, fruit mill or pulper.	7 lecture
Unit 4	Dairy processing and machinery: Storage silos, Cream separation, homogenization and churning.	7 lecture

Recommended Books :

- 1 Fundamentals of Food Process Engineering, R.T. Toledo, 2ndEd., CBS Publishers and Distributors, New Delhi, 1997.
- 2 Unit Operations in Chemical Engineering, McCabe, Smith and Harriot, 5th Ed., McGraw Hill Book Co., New York, 1993.
- 3 Transport Processes and Unit Operations, C.J. Geankopolis, 3rd Ed., Prentice Hall of India, New Delhi, 1999.
- 4 Food Engineering Operations, Brennan, Butters Cowell and Lilley, 3rd Ed., Elsevier Applied Science, Amsterdam, 1990.

AE2152 Food Processing Plant Practice: 4 Credits (1-0-5)

Unit 1	Instrumentation for measurement of food process parameters: Temp., pressure, moisture, humidity, density, flow and level.	4 lectures
Unit 2	Steam generation and refrigeration in a food processing plant.	2 lectures
Unit 3	Cleaning, sanitation and sterilization of food processing and handling equipment. Cleaning and disinfecting agents. HACCP concept of food processing. Effluent treatment from food industry.	4 lectures
Unit 4	Food Packaging: introduction to food packaging, food packaging materials, filling mechanisms for solid and liquid foods and closing or sealing mechanism. FFS, Aseptic packaging of foods.	4 lectures

Recommended Books :

- 1 Measurement Systems, E.O. Doebelin, McGraw Hill Book Co., New York, 1984.
- 2 Principles of Industrial Instrumentation, D. Patranabis, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1985.
- 3 Dairy Plant Engineering Management, T. Ahmed, KitabMahal, New Delhi, 1997.
- 4 Thermal Engineering, P.L. Ballaney, Khanna Publishings, New Delhi, 1995.

AE2200 Farm Equipment and Maintenance: 4 Credits (2-0-3)

Unit 1	Agricultural mechanization: Scope, benefits and limitations. Sources of power in agricultural farm and their comparison.	4 lectures
Unit 2	Introduction to implements for tillage and seedbed preparation. Maintenance of tillage implements.	6 lectures
Unit 3	Introduction to equipment used for sowing, planting and inter-culture operation, and their maintenance.	6 lectures
Unit 4	Introduction to equipment used for irrigation and plant protection, and their repair and maintenance.	6 lectures
Unit 5	Introduction to equipment used for harvesting and threshing, and their repair and maintenance.	6 lectures

Recommended Books:

- 1 Farm Workshop and Maintenance, 3rd Ed., V.K. Moore, English Language Book Society, London, 1984.
- 2 Farm Machinery and Equipment, 6th Ed. H.P. Smith and L.H. Wilkis, Tata McGraw Hill Publishing Co. Ltd. New Delhi, 1988.
- 3 Maintenance of Farm Machinery, P.H. Southwell, O.E.C. Publication, Paris, 1995.
- 4 Elements of Agricultural Engineering, 5th Ed., J. Sahay, Agro Book Agency, Patna, 2005.

AE2201 Tractor Service Centre Management: 3 Credits (2-1-0)

Unit 1	Selection of site for tractor service centre: Urban area, semi-urban area, rural area, and their comparison.	6 lectures
Unit 2	Tools and equipment required for tractor and power tiller overhauling: Hand tools and power tools.	6 lectures
Unit 3	Plant layout: Objectives and advantages. Industrial safety: Objectives, causes of accident, hazard and warning signs, and precautions.	8 lectures
Unit 4	Types of hiring: Custom hiring, rent, lease etc., and their comparison. Cost estimation, brake even analysis. Project management: Project planning, project control, human aspect of project control.	8 lectures

Recommended Books:

- 1 Massey Ferguson 1035 Tractors Service Manual, Tractor and Farm Equipment Ltd. Chennai.

AE2202 Tractor Systems: 5 Credits (2-0-5)

Unit 1	Introduction to transmission system: Clutch, gearbox, differential, final drive and rear axle. Adjustment, fault diagnosis, causes, and remedies of transmission system.	10 lectures
Unit 2	Introduction to front axle. Steering system: Functions and mechanism. Wheel alignment and reversibility.	7 lectures
Unit 3	Electrical system of tractor: Self-starter, dynamo, alternator, battery, electrical circuits, wiring, and their repair and maintenance.	7 lectures
Unit 4	Power tiller: Make and models, components, control and operational techniques, and repair and maintenance.	4 lectures

Recommended Books:

- 1 Farm Tractor Maintenance and Repair, 4th Ed., S.C. Jain and C.R. Rai, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1992.
- 2 Elements of Agricultural Engineering, 3rd Ed., J. Sahay, Agro Book Agency, Patna, 1992.3 Diesel Machines, 3rd Ed., E.J. Schulz and B.L. Evridge, McGraw Hill International, New York, 1988.

AE2203 Fruits and Vegetables Processing: 4 Credits (2-0-3)

Unit 1	Principles of fruits and vegetables processing. Primary, secondary and tertiary processing of fruits and vegetables. Post harvest physiology of F&V.	7 lectures
Unit 2	Fresh storage of fruits & vegetables. Blanching: Concept and methods. Drying and dehydration of fruits vegetables.	7 lectures
Unit 3	Manufacture of juices, squash, concentrates, jams, jellies, fruit bars, candies, juice powder, chutneys, pickles etc. Quality control in fruits & vegetables processing.	7 lectures
Unit 4	Canning and Freezing of fruits and vegetables. Effluent handling. Concept of marketing of fruits & vegetables products.	7 lectures

Recommended Books :

- 1 Preservation of Fruits and Vegetables, Giridharilal, G.S. Siddappa and G.L. Tanden, ICAR Publications, New Delhi, 1998.
- 2 Preservation of Fruits and Vegetables products, R.P. Srivastava, Bishen Singh and Mahendra Pal Singh, Dehradun, 1982.
- 3 Commercial Vegetable Processing, B.S. Luh and J.G. Woodroof, AVI Publishing Co. Inc., USA, 1988.

AE2204 Milk Processing: 4 Credits (2-0-3)

Unit 1	Milk and milk properties.	3 lectures
Unit 2	Milk reception, straining, filtration, clarification, standardization. Storage and transportation of milk.	5 lectures
Unit 3	Cream separation, Homogenization, pasteurization and sterilization. drying, fermentation, evaporation etc.	12 lectures
Unit 4	Production of market milk, sweet cream, ripened cream, butter, ghee, cheese, flavoured milk, ice cream etc. Quality control in milk processing. Effluent handling of dairy industry. Marketing concept of dairy products.	8 lectures

Recommended Books :

- 1 Outline of Dairy Technology, S.Dey, Oxford University Press, Oxford, 1997.
- 2 Milk and Milk Products, C.H. Eckles, W.B. Comb and H. Macy, 4th Ed., Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1998.
- 3 Indian Dairy Products, K.S. Rangana and K.T. Acharya, Asia Publishing House, New Delhi, 1974.
- 4 Principles of Dairy Processing, J.N. Warner, New Age International Pvt. Ltd., New Delhi, 1976.

AE2205 Meat, Fish and Egg Processing: 4 Credits (2-0-3)

Unit 1	Development of meat and poultry industries in the North East. Pre-slaughter care and lectures antimortem inspection.	7 lectures
Unit 2	Methods of stunning, slaughtering, dressing of meat, meat tenderization. Physiology of slaughtered meat, fish and egg. Transportation and handling of meat, fish and egg.	7 lectures
Unit 3	Preservation of meat, egg, fish and their products. Canning of fish, preparation of fish meal, pickle, paste etc.	10 lectures
Unit 4	Quality evaluation of meat, fish and egg produces. Effluent handling. Concept of marketing of meat, fish and egg products.	4 lectures

Recommended Books :

- 1 Fish Processing Technology, T.K. Govindan, Oxford and IBH Publishing Co., New Delhi, 1985.
- 2 Processed Meats, A.M. Pearsen and T.A. Gillett, 3rd Ed., CBS Publishers and Distributors, New Delhi, 1997.
- 3 Fish Smoking and Drying, Eddy, J.R. Burt, Elsevier Applied Science, London, 1988.
- 4 Food Science, N.N. Potter, 5th Ed., CBS Publishers and distributors, New Delhi, 1996.

Department of Civil Engineering

Programme: Certificate in Construction Technology

Year I						
Semester I						
S.N.	Course Code	Course Title	L	T	P	Credits
1	HS 1101	Remedial English I	2	0	2	3
2	PH 1101	Physics - I	4	0	2	5
3	CY 1101	Chemistry - I	3	0	2	4
4	MA 1101	Mathematics - I	3	1	0	4
5	ES 1151	Engineering Drawing	0	0	6	3
6	ME 1152	Workshop Practice	0	0	8	4
						23
Semester II						
1	HS 1201	Remedial English II	2	0	2	3
2	PH 1201	Physics - II	4	0	2	5
3	CY 1201	Chemistry - II	3	0	2	4
4	MA 1201	Mathematics - II	3	1	0	4
5	CE 1201	Construction Materials	3	0	0	3
6	CE 1251	Civil Engineering Drawing - I	0	0	6	3
7	ES 1200	Basic Electrical and Electronics Engineering	4	0	2	5
						27
Year II						
Semester I						
1	MA 2101	Mathematics - III	3	1	0	4
2	CE 2101	Construction Technology	3	0	0	3
3	CE 2102	Building Construction and Maintenance	3	0	2	4
4	CE 2103	Surveying - I	2	0	2	3
5	CE 2104	Water Supply and Sanitary Services	2	0	2	3
5	CE 2105	Estimating and Quantity Surveying	2	1	0	3
6	CE 2151	Civil Engineering Drawing - II	0	0	4	2
						22
Semester II						
1	HS 2201	Entrepreneurship and Environmental Education	3	0	0	3
2	CE 2201	Technical Mechanics	3	1	0	4
3	CE 2250	Civil Engineering Workshop	0	0	4	2
4	CS 2200	Basics of Computers	2	0	2	3
5	ED 2200	Extra Curricular Activities and Discipline	0	0	0	2
Surveyor						
1	CE 2202	Survey Trade Theory	4	0	0	4
2	CE 2251	Survey Practice - I	0	0	6	3
3	CE 2252	Survey Practice - II	0	0	6	3
Draftsman						
1	CE 2203	Building Planning and Architecture	2	0	4	4
2	CE 2253	Civil Engineering Drafting - I	0	0	6	3
3	CE 2254	Civil Engineering Drafting - II	0	0	6	3
						22+2

Courses offered by the Civil Engineering Department to other Departments

Module	Course Code	Course Title	Contact Hours (L-T-P:Cr)	Offered to the Students of
Base	ES 1151	Engineering Drawing	0 0 6 3	AE, CE, EE, EC, and ME

COURSE CONTENTS

ES 1151 Engineering Drawing: 3 Credits (0-0-6)

Conventional lines & Lettering; Scales; Engineering curves: Conic sections, Cycloid, Involute, Spirals, Helix, etc.; Projection of Points and Straight lines; Projection of Planes; Projection of Solids; Projection on Auxiliary Planes; Section of Solids; Development of surfaces; Isometric Views, Orthographic projections.

Recommended Books :

1. Elementary Engineering Drawing, N.D. Bhatt and V. M. Panchal, Charotar Publishing House, Anand, India, 2000.
2. Engineering Drawing, Venugopal, Wiley Eastern Ltd, New Delhi, 1998.
3. Engineering Drawing and Graphics Technology, French T.E., Verick C.S. and Forester, R.J., McGraw Hill International, Singapore, 1993.

CE 1201 Construction Materials: 3 Credits (3-0-0)

Unit I	Introduction to Construction Materials, Selection of materials for different Civil Engineering works, Rock: Classification, quarrying and dressing. Bricks: Manufacturing processes, classification and tests. Flooring and roofing tiles.	10 lectures
Unit II	Production, properties and uses of lime; cement and sand-mortar. Concrete: Plain and reinforced.	10 lectures
Unit III	Timber: types and methods of preservation, plywood. Iron and structural steel. Introduction to modern construction materials: laminated timber board, MDF board, ACC blocks, wall fabric materials, etc.	10 lectures
Unit IV	Types and uses of paints; varnishes and distemper. Sound and heat insulating materials; Glasses; plastics and asphaltic materials.	12 lectures

Recommended Books:

1. Basic Civil Engineering, Dr. B. C. Punmia & Ashok K. Jain & Arun K. Jain, Laxmi Publication, 2003.
2. Engineering Materials, Rangwala, S.C., Charotar Publishing House, Anand, India, 2016.
3. Elements of Civil Engineering, Dr. Anurag Kandya, Charotar Publishing House, Anand, India, 2015.

CE 1251 Civil Engineering Drawing I : 3 Credits (0-0-6)

Orthographic Views; Oblique Views; Perspective Views; Signs and symbols of building materials; Bond in Brick Masonry (orthographic and isometric); Bonds in Stone Masonry; Sub-structure details; Doors, windows and ventilators; Arches and Lintels; Timber joints and Trusses.

Recommended Books :

1. Civil Engineering Drawing, R.S.Malik & G.S. Meo, New Asian Publications, Delhi, 1987.
2. Civil Engineering Drawing, M. Chakraborty, Author, Calcutta, 1996.
3. Principles of Building Drawing, Shah M.G., and Kale C.M., MacMillan India Ltd, New Delhi, 1995.
4. Building Drawings, Shah M.G., Kale C.M. and Patki S. Y., Tata McGraw Hill, New Delhi, 1993.

CE 2101 Construction Technology : 3 Credits (3-0-0)

Unit I	Roads classification, Geometrical features of roads, Construction of WBM, Black top and concrete pavements including grade and base courses. Equipments used for road construction, features of hilly roads.	12 lectures
Unit II	Railways - Components of Railway tracks, Construction and Maintenance of tracks.	10 lectures
Unit III	Bridge and Culverts - Types of bridges/culverts, criteria for selection of sites, Construction and maintenance of bridges/culverts.	10 lectures
Unit IV	Hydraulic Structures - Construction details of dam, construction details of canals/other hydraulic structures.	10 lectures

Recommended Books:

1. Highway Engineering, S K Khanna and C E G Justo, Nem Chand and Brothers, Roorkee, India, 1982.
2. A Text Book of Railway Engineering., Arora & Saxena, Dhanpat Rai and Sons, New Delhi, 1981.
3. Elements of Bridge Engineering., J Victor, Oxford and IBH, New Delhi, 1991.
4. Irrigation Engineering & Hydraulic Structures, S.K. Garg, Khanna Publishers, Delhi, 1993.
5. Text Book of Railway Engineering, B.L. Gupta, Standard Publishers, New Delhi, 1997.

CE 2102 Building Construction and Maintenance: 4 Credits (3-0-2)

Unit I	Foundation: Classification and construction, Brick masonry, partition, cavity and curtain walls, scaffolding, underpinning and shoring.	10 lectures
Unit II	Door and windows; Solar passive aspects of windows; Brick and RCC arches and lintels.	8 lectures
Unit III	Roofs: Classification and coverings; Floors: Ground and upper floors,; Cement, concrete, mosaic, stone, tile, laminated timber and other floors; Damp proofing treatment in various components of building.	8 lectures
Unit IV	Stairs; Protective and Decorative finishes, Wall papering, tiling, stone cladding.	8 lectures
Unit V	Maintenance and repairs of foundations, walls, floors, roofs, wooden and metal parts, and Strengthening, retrofitting, rehabilitation of old and damaged structures.	8 lectures

Recommended Books:

1. Building Construction, B.C. Punmia, Laxmi Publishers, New Delhi, 1998.
2. Building Construction, Shushil Kumar, Standard Publishers, Delhi, 1999.
3. Building Construction Vol. I to IV, W.B. Mackey, Orient Longman, Mumbai, 1993.
4. Building Construction and Materials, Gurucharan Singh, Standard Book House, New Delhi, 2010.
5. Practical Handbook on Building Construction, M. K. Gupta, Nabhi Publication, New Delhi, 2005.
6. Maintenance of Building, A.C. Panchdhari, New Age International, New Delhi, 1997.
7. Maintenance Manual, CPWD 2012.
8. National Building Code, BIS, New Delhi, 2005.

CE 2103 Surveying-I : 3 Credits (2-0-2)

Unit I	Introduction, classification of survey, chain surveying - principle, instruments used, procedure, Problems and errors in chain survey.	7 lectures
Unit II	Compass surveying: types, description and uses, measurement of bearings in WCB and QB systems, local attraction and related problems.	7 lectures
Unit III	Plane table surveying: methods of plane tabling, two- point and three- point problems and their solutions, errors in plane tabling.	7 lectures
Unit IV	Leveling: leveling principles, booking and reduction of levels, different types of leveling, related problems and practices.	7 lectures

Recommended Books:

1. Surveying Vol. I, B.C.Punamia, Laxmi Publications, New Delhi, 2005.
2. Surveying Vol. I, S.K.Duggal, Tata McGraw Hill, New Delhi, 1996.
3. Surveying and Levelling Vol. I, T.P. Kanetkar and S.V. Kulkarni, Pune Vidyarthi Griha Parkashan Pune, 2000
4. Surveying & Levelling, Rangwala, Charotar Publishing House, Anand, India, 2014.
5. Surveying Vol.I, Dr. K.R. Arora, Standard Book House, Delhi, 2013.

CE 2104 Water Supply and Sanitary Services : 3 Credits (2-0-2)

Unit I	Sources of water, wells, tube wells, method of construction, types of pumps, with fittings.	5 lectures
Unit II	Collection of surface water and its conveyance through pipes, pipe laying, lake and corrosion in pipes and their remedial measures.	6 lectures
Unit III	Appurtenances in distribution system, Sanitary systems- Conservancy and water carriage systems, construction and maintenance of privies, Septic tanks, imhoff tanks.	7 lectures
Unit IV	Construction and maintenance of sewers, sewer appurtenances.	5 lectures
Unit V	Plumbing equipments and operations, Water supply and sanitary fittings, house drainage, concepts of rural water supply and sanitation.	5 lectures

Recommended Books:

1. Environmental Engineering Vol. I: Water Supply Engineering, S.K. Garg, Khanna Publishers, Delhi, 1998.
2. Environmental Engineering Vol. II: Sewage Disposal & Air Pollution Engineering, S.K. Garg, Khanna Publishers, Delhi, 1998.
3. Wastewater Engineering: Treatment, Disposal & Reuse, Metcalf & Eddy, Tata McGraw Hill, New Delhi, 1991.
4. Elements of Public Health Engineering, K.N. Duggal, S. Chand & Co, New Delhi, 2000.
5. Water Supply & Sanitary Engineering, S.C. Rangwala, Charotar Publishing House, Anand, India, 2000.
6. Water Supply and Sanitary Installations, A C Panchdhari, New Age International, New Delhi, 1993.

CE 2105 Estimating and Quantity Surveying : 3 Credits (2-1-0)

Unit I	Unit of measurements and payments, Methods of estimates & examples.	4 lectures
Unit II	Preparation of detailed estimates of earthwork, masonry, concreting, flooring.	6 lectures
Unit III	Estimates of plastering, white washing and painting, wood and steel work, RCC work and sanitary fittings, Estimate preparation for buildings, roads,.	6 lectures
Unit IV	Estimate preparation for culvert, water tank, septic tank and retaining wall.	8 lectures
Unit V	Rate analysis for construction materials and various items of work.	4 lectures

Recommended Books:

1. Estimating & Costing in Civil Engineering, B.N. Dutta, UBS Publishers Distributors Ltd., New Delhi, 1998.
2. Estimating, Costing, Specifications & Valuation, M Chakroborty, Author, Calcutta, 1992
3. Estimating & Costing Professional Practice, S.C. Rangwala, Charotar Publishing House, Anand, India, 1995.
4. Quantity Surveying: Estimating and Costing, P L Bhasin, S Chand & Co, Delhi, 1982.

CE 2151 Civil Engineering Drawing II : 2 Credits (0-0-4)

Riveted, Bolted and Welded Joint; Steel Truss, Reinforcement details in beams and columns; Stair cases, Single Storeyed Residential Buildings (pitched roof) -Type II, Double Storeyed Residential Building with Flat Roof -Type III, Simple drawings of above topics on computer Graphics.

Recommended Books:

1. Civil Engineering Drawing, R.S.Malik & G.S. Meo, New Asian Publishers, Delhi, 1987.
2. Civil Engineering Drawing, M. Chakroborty, Author, Calcutta, 1996.
3. Building Drawings, Shah M.G., Kale C.M. and Patki S. Y., Tata McGraw Hill, New Delhi, 1993.
4. Related Softwares

CE 2201 Technical Mechanics: 4 Credits (3-1-0)

Unit I	Forces in a Plane and Equilibrium of Particles: Vector operations, Multiplication and division of a vector by a scalar, Vector addition, Vector subtraction, Resolution of a vector, Forces on a particle, Resultant of two forces, Addition of a system of coplanar forces, Rectangular components of a force, Unit vectors, Equilibrium of a particle.	8 lectures
Unit II	Equilibrium of Rigid Bodies: External and internal forces, Equivalent forces, Vector product of two vectors, Moment of a force about a point, Varignon's theorem, Rectangular components of the moment of a force, Moment of a force about a given axis, Replacing a force with an equivalent force-moment system at a given point, Replacing a force-moment system (with F perpendicular to M) with a single equivalent force, Free body diagram, Equilibrium of a rigid body in two dimensions, Equilibrium of a two-force body, Equilibrium of a three-force body.	14 lectures
Unit III	Friction: Laws of dry friction, Coefficient of friction, Angles of friction, Problems involving dry friction.	8 lectures
Unit IV	Kinematics of Particles: Rectilinear Motion: Position, Displacement, Velocity, and Acceleration, Determination of Rectilinear Motion, Relative Rectilinear Motion, Dependent Rectilinear motions. Curvilinear motion: Position vector, Velocity and Acceleration, Free flight of a projectile, Tangential and normal components, Radial and transverse components, Cylindrical components.	12 lectures

Recommended Books:

1. Vector Mechanics for Engineers, Statics and Dynamics, Beer and Johnston, Tata McGraw Hill, New Delhi, 1999.
2. Engineering Mechanics, Statics and Dynamics, Hibbeler, Pearson Education Asia Pvt. Ltd., New Delhi, 1997
3. Engineering Mechanics, Statics and Dynamics, Meriam and Kraige, John Wiley & Sons, NY, 1997.
4. Engineering Mechanics, S Timoshenko, D H Young, and J V Rao, Tata McGraw Hill, New Delhi 2007
5. Engineering Mechanics, S S Bhavikatti, K G Rajashekarappa, John Wiley, NY, 1994

CE 2202 Survey Trade Theory : 4 Credits (4-0-0)

Unit I	Introduction to theodolite: components and their functions, temporary adjustment; setting up of theodolite.	12 lectures
Unit II	Measurement of horizontal and vertical angles, direct and deflection angles, field notes, adjustment of errors, setting out straight lines through obstacles like ponds, buildings, hills etc.	16 lectures
Unit III	Permanent adjustment of theodolite, theodolite traversing, Height and Distance problems.	14 lectures
Unit IV	Omitted measurements and calculations, methods of computation of areas and volumes.	14 lectures

Recommended Books:

1. Surveying Vol. I & II, B.C.Punamia, Laxmi Publications, New Delhi, 2005.
2. Surveying Vol. I & II, S.K.Duggal, Tata McGraw Hill, New Delhi, 1996.
3. Surveying and Levelling Vol. I & II, T.P. Kanetkar and S.V. Kulkarni, Pune Vidyarthi Griha Parkashan Pune, 2000
4. Surveying & Levelling, Rangwala, Charotar Publishing House, Anand, India, 2014.
5. Surveying Vol.I, Dr. K.R. Arora, Standard Book House, Delhi, 2013.
6. Surveying and Levelling, N.N. Basak, Tata McGraw Hill, New Delhi, 1994.

CE 2203 Building Planning and Architecture: 4 Credits (2-0-4)

Unit I	Types of Building, NBC classification, Site selection, Building Bye-laws and regulation for urban buildings.	8 lectures
Unit II	Orientation and functional requirements of buildings.	6 lectures
Unit III	Elements of aesthetics in architecture, unity, mass, contrast, proportion, scale balance, symmetry, etc.	6 lectures
Unit IV	Features of Roman/Gothic, Indian, Muslim and modern architecture.	8 lectures

Recommended Books:

1. The Great Ages of World Architecture, G.K. Hiraskar, Dhanpat Rai & Sons, New Delhi, 1994.
2. History of Architecture, Fletcher, C.B.S. Publication, New Delhi, 1999.
3. Planning and Designing Building, Y.S. Sane, Engineering Book Publishing Co. Pune, 1959.
4. National Building Code, B.I.S., New Delhi, Latest Publication.

CE 2250 Civil Engineering Workshop: 2 Credits (0-0-4)

Plumbing work : Bending, cutting, threading, Practice in cutting, bending and fixing reinforcement in RCC work; welding of rods, angles with gusset plates; Fabrication of steel frames ; Assembly of frames and shutters of doors and windows and trusses.

CE 2251 Survey Practice I : 3 Credits (0-0-6)

Leveling; Type of Instruments, Temporary and Permanent Adjustments, Methods of observations, Booking and Reduction of Levels; Differential and reciprocal leveling, Practice in Differential and Reciprocal Leveling, Establishing Bench Marks, Fly Leveling, Performing permanent Adjustment of a Level, Contours, Laying of Roads and Drains; Setting out of Route Survey, Longitudinal and Cross-section of a Road Project, Plotting and Calculation of Earthwork, Related practice.

Recommended Books:

1. Surveying Vol. I, B.C.Punamia, Laxmi Publications, New Delhi, 2005.
2. Surveying and Levelling Vol.I, T.P. Kanetkar and S.V. Kulkarni, Pune Vidyarthi Griha Parkashan Pune, 2000.
3. Surveying & Levelling, Rangwala, Charotar Publishing House, Anand, India, 2014.
4. Surveying Vol. I, S.K.Duggal, Tata McGraw Hill, New Delhi, 1996.
5. Surveying Vol.I, Dr. K.R. Arora, Standard Book House, Delhi, 2013.

CE 2252 Survey Practice II : 3 Credits (0-0-6)

Measurement of area by planimeter; Use of minor instruments like Ghat tracer, Abney level and Box Sextant. Practice of setting theodolite and taking readings; Measurement of horizontal and vertical angles; Setting out given vertical angles and entering in the field books; Setting out straight line through obstacles, extending given lines, establishing lines at given angles with given lines, setting out rectilinear figures; Theodolite traversing and plotting; Preparation of contour maps; Topographical survey with the help of Theodolite Height and distance of accessible and inaccessible objects.

Recommended Books:

1. Surveying Vol.-I, B.C.Punamia, Laxmi Publications, New Delhi, 1994.
2. Surveying & Levelling Vol.-I, T.P.Kanetkar & S.V. Kulkarni, Pune Vidyarthi Griha Prakashan, Pune, 1985.

CE 2253 Civil Engineering Drafting I : 3 Credits (0-0-6)

Unit I	Residential Buildings, Industrial building, Public building.	6 turns
Unit II	Bar bending schedule, Structural drawings of RCC elements, foundations for heavy structures (Grillage/Isolated column footing, pile and well foundation).	8 turns
Unit III	Beam column and eccentric connections in steel structures, plate girder.	4 turns
Unit IV	Pipe joints, Septic tanks and soak pits, manholes.	4 turns
Unit V	Simple drawing of above topics in computer graphics.	6 turns

Recommended Books:

1. Civil Engineering Drawing, Malik & Meo, New Asian Publications, Delhi, 1987.
2. Civil Engineering Drawing, M. Chakraborty, Author, Clacutta, 1996.
3. Design of Steel Structures, Kazmi & Jindal, Prentice Hall & India, New Delhi, 1987.
4. Civil Engineering Drawing Manual, Thanikachalam & Natarajan, S. Chand & Co., New Delhi, 1984.
1. Building Drawings, Shah M.G, Kale C.M. and Patki S. Y., Tata McGraw Hill, New Delhi, 1993.
5. Related Softwares

CE 2254 Civil Engineering Drafting II : 3 Credits (0-0-6)

Unit I	Culverts, Bridges.	5 turns
Unit II	Dams, Weir, Barrage and cross Drainage works.	6 turns
Unit III	Hydrographs & Reservoir area capacity curve.	3 turns
Unit IV	Cross sectional details of pavements/road and railway tracks; units of water treatment plant and sewage treatment plant.	6 turns
Unit V	Tracing, Inking, and Reproduction methods.	2 turns
Unit VI	Simple drawings of above topics in computer graphics.	6 turns

Recommended Books:

1. Civil Engineering Drawing, Malik & Meo, New Asian Publications, Delhi, 1987.
2. Civil Engineering Drawing Manual, Thanikachalam & Natarajan, S. Chand & Co., New Delhi, 1984.
3. Irrigation and Water Power Engineering., B.C. Punmia and B B Lal, Standard Publishers & Distributors, Delhi, 1986.
4. Related softwares

Department of Electrical Engineering

Programme: Certificate in Electrical Engineering

Year I						
Semester I						
S.N.	Course Code	Course Title	L	T	P	Credits
1.	HS 1101	English - I	2	0	2	3
2.	PH 1101	Physics - I	4	0	2	5
3.	CY 1101	Chemistry - I	3	0	2	4
4.	MA 1101	Mathematics - I	3	1	0	4
5.	ES 1151	Engineering Drawing - I	0	0	6	3
6.	ES 1152	Workshop Practice	0	0	8	4
		Total				23
Semester II						
S.N.	Course Code	Course Title	L	T	P	Credits
1.	HS 1201	English - II	2	0	2	3
2.	PH 1201	Physics - II	4	0	2	5
3.	CY 1201	Chemistry - II	3	0	2	4
4.	MA 1201	Mathematics - II	3	1	0	4
5.	ES 1200	Basic Electrical and Electronics Engineering	4	0	2	5
6.	EE 1251	Electrical Drawing	0	0	6	3
7.	EE 1252	Electrical Workshop	0	0	6	3
		Total				27
Year II						
Semester I						
S.N.	Course Code	Course Title	L	T	P	Credits
1.	MA 2101	Mathematics - III	3	1	0	4
2.	EE 2101	Domestic Wiring and Service Connection	2	0	6	5
3.	EE 2102	Electrical Measuring Instruments	3	0	2	4
4.	EE 2103	Electrical Trade Theory	3	0	0	3
5.	EE 2104	Operation and Maintenance of Electrical Machine	2	0	2	3
6.	EE 2151	Electrical Maintenance Lab- I	0	0	6	3
		Total:				22
Semester II						
S.N.	Course Code	Course Title	L	T	P	Credits
1.	HS 2201	Entrepreneurship	3	0	0	3
2.	ES 2200	Basics of Computers and Programming	2	0	2	3
3.	ES 2201	Technical Mechanics	3	1	0	4
4.	EE 2201	Electrical Installation and Practice	2	0	2	3
5.	EE 2202	Electrical Appliances	3	0	2	4
6.	EE 2251	Electrical Maintenance Lab-II	0	0	4	2
7.	EE 2299	Job Training/Project	0	0	6	3
8.	ED 2288	Extra Curricular Activities and Discipline	0	0	0	2
		Total:				22+2

COURSE CONTENTS

ES-1200 Basic Electrical and Electronics Engineering : 5 Credits (4-0-2)

Unit-I	Effect of electric current, electromagnetism, AC circuits using R, L & C, single phase and three phase circuits; batteries: types of cells and basic operation of Lead acid, Ni-Cd, Nickel-alkaline cells, charging and maintenance.	10 lectures
Unit-II	Elementary idea of rotating electrical machines and transformer: working principle, types, rating and constructions.	12 lectures
Unit-III	Resistors, capacitors and inductors, definitions, types (fixed and variable) color code, ratings; Special components: Thermistor, VDR, LDR and their uses.	10 lectures
Unit-IV	Semiconductors: intrinsic and extrinsic, PN junction diode, diode ratings; Application of diodes: half and full wave rectifier, rectifier filter, clipping and clamping, voltage multiplier etc. Special diodes: Zener diode, LED, Varactor diode, photo diode, solar cell, principles and uses.	12 lectures
Unit-V	Transistor: definition, PNP and NPN types, CE, CC, CB amplifier circuits; Introduction to SCR, characteristics and applications; Oscillators: definition with example, circuits; Digital Electronics: elementary ideas on binary numbers and logic gates (AND, OR, NOT), ICs Pin configuration of some specific ICs.	12 lectures
Total lectures		56

Recommended Books:

1. Basic Electronics and linear circuits by Bhargava, Kulshreshtha and Gupta, TTTI Chandigarh
2. A Text Book of Electrical Technology (Vol I) by B.L. Thereja, S. Chand Publication
3. Fundamentals of Electronics by E. Norman Lurch (John Wiley & Sons)
4. Basic Electronics by Mavino A.P. (Mc. Graw Hill)
5. Basic Electrical Engg. (Vol-I) By P.S. Dhogal TMH.
6. Electrical Engg. by H.Cotton.
7. Electrical Trade Theory, by M.L. Ghosh - TMH

EE-1251 Electrical Drawing : 3 Credits (0-0- 6)

Unit-I	Electrical Symbols and Tools: Symbolic representation, Fuse assembly, knife, Cable lugs, brush holder, wire joints, etc.
Unit-II	Electrical Machines: Transformers, DC machines, Field poles, Armature, Commutator, lap and wave windings, AC machines: rotor and stator of induction machine, synchronous machine and single phase machines.
Unit-III	Electrical Measuring Instruments: Drawing of common electrical measuring instruments such as Moving coil, Moving iron, Electrodynamometer type, induction type of ammeter, voltmeter, wattmeter, energy meter; megger, frequency meter, power factor meter, etc.
Unit-IV	Electrical Power Generating and Substations: Layout diagram of hydro power plant, thermal power plant, nuclear power plant, distribution substation. 11KV and 33KV substations, layout of switch gear and transformer, layout of power plants and substation.
Unit-V	Power System Equipments and Control: Panels for DC generator and alternators, Control panel of substations, pole and towers, HT and LT Insulators, Earthing systems, Circuit breakers, lightning arrestors, air break switches, House wiring.

Recommended Books:

1. Electrical Engineering Drawing by S.K. Bhattacharya, Willey Easter Ltd.
2. Electrical Engineering Drawing by R.B. Sharma, Satya Publications
3. Electrical Design; Estimation & Costing by K.B. Raina & S.K. Bhattacharya, New Age Int.
4. Electrical Substation and Practice by S. Rao, Khanna Publication
5. Electrical Engineering Drawing by Nagar, Satya Publications

EE-1252 Electrical Workshop : 3 credits (0-0- 6)

Unit-I	Electrical Workshop: electrical symbols; voltage, current; resistance; power relations; wire joints;
Unit-II	Switchboard connection; simple wiring in TRS and PVC conduit system; Stair case wiring.
Unit-III	Wiring practice of various types of lamps and fans; Energy meter and mains board connection, electrical measurement, wiring for backup power supply including inverter, battery and load, etc.
Unit-IV	Identification and study of different types of cables/wires and switches and their uses, study of different types of fuses & fuse carriers, MCB (miniature circuit breaker), ELCB (Earth Leakage Circuit Breaker), MCCB (Molded Case Circuit Breaker) and RCCB (Residual Current Circuit Breaker) with ratings and usages. Wiring of Power circuit for controlling power device (16A socket), wiring of power distribution arrangement using single phase MCB distribution board with ELCB.
Unit-V	Identification of different windings and components of D.C and AC machines, Dismantling and assembling of a ceiling-fan or table fan, single phase transformer. Testing of battery for its charged and discharged condition and to make connections for charging.

Recommended Books:

1. Electrician: 1st year Trade Theory: CIMI Madras, New Age International Publication.
2. Electrical Trade Theory: by M.L. Ghosh, Tata McGraw Hill.
3. Fundamentals of Electrical Engineering and electronics by B.L. Thereja, Nirja Publication.
4. Introduction to Computers (5th edition) by Peter Norton TMG

EE-2101 Domestic Wiring and Service Connection : 5 Credits (2-0-6)

Unit-I	Wiring – types of wiring: cleat wiring, casing and capping wiring; various types of wood joints, applications, link clips, wooden screw, wooden plugs etc., their applications. Conduit wiring, conduit accessories, PVC conduit & metal conduit. Specifications of electrical wiring accessories; wires and cables, switches, GI wires, GI strips. Holders, various types, ceiling rose etc.	5 lectures
Unit-II	Domestic, Industrial and decorative light fittings, stair case wiring, godown wiring, series parallel wiring, multiple point wiring, cable termination, IS 732-1982 code of Practice for internal wiring; guideline for internal wiring, wiring technique; looping in junction box, tree ring etc., advantages and disadvantages, applications. Use of intermediate switch for wiring and various applications.	5 lectures
Unit-III	Preparation of wiring diagram; schematic single line and multi-line wiring diagrams using NEC symbols, testing of low and medium voltage wiring installation. Service connection; types, suitability, service cable selection, erection, and application. Fuses; types, ratings, materials, testing, different types of switch, fuse units, applications.	5 lectures
Unit-IV	Earthing, system and equipment earthing, purpose, types of earthing, electrodes, earth leakage circuit breaker. Measurement of earth resistance IS 3043 code of practice for earthing, measures to improve earthing.	4 lectures
Unit-V	Estimates; abstract, detailed (main & sub) supplementary and revised estimate. Work contract (Lump sum, schedule & piece work contract). Tender: single, limited, open, global, security deposit, general condition and technical specification, measurement books. Preparation of estimate for small low and medium voltage installation. Inventory control.	9 lectures
Total lectures		28

Recommended Books:

1. Electrical Estimating & Costing, K.B.Raina, Tata McGraw Hill, New Delhi, 1996.
2. Electrical Design: Estimating and Costing, K.B.Raina & S.K.Bhattacharya, , New Age,
3. Electrical Specification for Building Construction, J.E.Traise, Prentice Hall Inc, NJ,1978

EE-2102 Electrical Measuring Instrument : 4 credits (3-0-2)

Unit-I	Units and Dimensions, Absolute, Fundamental and Derived units, Dimensional analysis. MKS system, SI system, Practical units.	7 lectures
Unit-II	Absolute and Secondary instruments, essentials of indicating instruments, deflecting torque, controlling torque, damping torque, advantages of spring control over gravity control.	8 lectures
Unit-III	PMMC instrument: constructional details, principle of operation, uses, advantages and disadvantages. Loading effect of voltmeter and voltage drop effect of ammeter in circuits; extension of ranges of ammeter and voltmeter and related problems. Moving Iron instruments: constructional details, types, principle of operation, advantages and disadvantages. Dynamometer type instruments: constructional details, types, principle of operation, advantages and disadvantages. Dynamometer type instruments as an ammeter and voltmeter. Ohmmeter: Series and shunt type, working, uses, Megger, its construction and working principle.	10 lectures
Unit-IV	Induction type instrument: Induction type ammeters and voltmeters, uses, advantages and disadvantages. Induction type wattmeter, constructional details, principle, advantages and disadvantages. Energy meters: constructional details, working principle, types, errors, testing and adjustment of Energy meter. Electromagnetic relay.	10 lectures
Unit-V	Frequency meters: classification, constructional and working principle, Electrodynamometer and moving iron power factor meter: working principle, types and uses.	7 lectures
Total lectures		42 lectures

Recommended Books:

1. A Course in Electrical and Electronics Meas. and Instr., A. K. Sawhney, Dhanpat Rai and Sons,
2. A Text Book of Electrical Technology (Vol-1) by B.L. Thareja, S. Chand & Company Ltd.

EE-2103 Electrical Trade Theory : 3 credits (3-0-0)

Unit-I	Basic concepts, Fundamentals of AC, electric circuit, circuit elements, Ohm's law Kirchhoff's laws and its applications.	7 lectures
Unit-II	Effect of electric current: heating effect, chemical effect, electromagnetic effect, electrostatic effect, primary and secondary cells, lead acid battery, battery charging, testing, application, maintenance.	7 lectures
Unit-III	Magnetism and electromagnetism: magnetic materials, terminology properties of magnetic lines of forces. Faraday's laws of electromagnetic induction, Lenz's law, Fleming's Left Hand and Right Hand rules.	8 lectures
Unit-IV	Transformers: Introduction to transformer and its basics, different types of transformers and their constructions, emf equation, ideal and practical transformers, their ratings and applications.	10 lectures
Unit-V	Introduction to Electromechanical energy conversion (EMEC) devices: generator and motor action, constructional features of elementary machines, generation of emf and torque, production of rotating magnetic fields, basic principles of dc machines, characteristics and its applications, basic principles of ac machines, characteristics and its applications.	10 lectures
Total lectures		42 lectures

Recommended Books:

1. Electrical Trade Theory by M.L. Ghosh. TMH
2. A Text Book of Electrical Technology (Vol-1) by B.L. Thareja, Nirja Publication.
3. Basic Circuit Analysis by K.V.V. Murthy & M.S. Kamath.
4. Electrical Circuits – Schaum Series.
5. Basic Electrical Engg. by P.S. Dhogal - TMH

EE-2104 Operation and Maintenance of Electrical Machine : 3 Credits (2-0-2)

Unit-I	Electromagnetic induction: Relation between magnetism and electricity, production of induced emf and current, Faraday's Laws of electromagnetic induction, direction of induced emf and current, Lenz's Law, dynamically and statically induced emf.	4 lectures
Unit-II	DC generator: constructional details, emf equation, circuit model, armature reaction and commutation process, self and separately excited generator, Testing of dc generator, applications, care and maintenance of dc generator	5 lectures
Unit-III	DC motors: principle and types, relation between applied voltage, back emf, armature voltage drop, starting and use of starters, types of starter, characteristics, speed control, testing and maintenance of dc motors.	5 lectures
Unit-IV	Induction motors: constructional details, principle of operation, concept of slip, rotor emf and current, torque equation, torque-slip characteristics, method of starting and testing.	6 lectures
Unit-V	Alternators: constructional details, types of alternators, principle of operation, synchronous speed and frequency, emf equation, characteristics and voltage regulation. Testing of alternators. Single phase motors: classification, principle of operation, starting and their applications	8 lectures
Total lectures		28

Recommended Books:

1. Testing, Commissioning, Opn. and Maintenance of Electrical Engineering by S. Rao, Khanna Pub.
2. Electrician 1st Year Trade Theory, CIMI, New Age International, New Delhi, 1998
3. Electrical Machinery, P. S. Bimbhra, Khanna Publication, New Delhi.
4. Electrical Machine, S. K. Bhattacharya, Tata McGraw Hill.

EE-2151 Electrical Maintenance Lab- I : 3 Credits (0-0-6)

1. Study of Electrical shock and treatment
2. Demonstration of safety accessories and tools
3. Measurement of power in single phase
4. Measurement of power factor in single phase
5. Measurement of power factor in three phase (star balance circuit)
6. Measurement of power factor in three phase (Delta balanced circuit)
7. Power cable jointing
8. Soldering and welding practice
9. Study of auto electric system in automobiles
10. Study of self-starter for automobiles

EE-2201 Electrical Installation and Practices : 3 Credits (2-0-2)

Unit-I	Generations: introduction, classifications, advantages and disadvantages, site selection, working principle, layout and main components of diesel, Thermal, hydro and Nuclear Power plants and Non-Conventional source of energy	6 lectures
Unit-II	Substation Practices: introduction, types of substations, power transformer and their parts, H.T and L.T metering, safety requirements, electrical diagrams, electrical symbols relevant to substations, various arrangements of bus bars, isolating switches, CT, PT, circuit breakers, lighting Arrestors. Substation earthing, protective measures as per relevant IE rules.	6 lectures
Unit-III	Transmission and Distribution lines by overhead lines systems: introduction, types of poles and their construction, mechanical design of overhead lines, overhead line conductors, insulators, stays, guarding wires, anticlimbing devices, etc.	6 lectures
Unit-IV	Distribution by Under Ground cables: introduction, types of underground cables used, factors determining selection of LT power cables, advantages and disadvantages in comparison to overhead lines, constructional details of cables, laying of underground cables and its terminations, consumer service connections, cable fault location, maintenance	5 lectures
Unit-V	Campus Lighting: terminology of illumination, laws of illuminations, street lighting, various types of light sources and design considerations of good lighting scheme and service feeder pillar.	5 lectures
Total lectures		28

Recommended Books:

1. Electrical substation engineering and practices, S.Rao, Khanna Publication, Delhi 1992
2. Electrical Power S.L Uppal, Khanna Publishing, Delhi 1996
3. Electrical Design estimating and Costing, K.B Raina, S.K Bhattacharya, WEL, New Delhi, 2003
4. Non-Conventional Energy Resources, D.S Chauhan & S.K Srivastava, New Age, New Delhi.

EE-2202 Electrical Appliances : 4 Credits (3-0-2)

Unit-I	Principles of electric heating appliances, power consumption, use and importance of name plate details, current rating, principle of temperature controls in heaters, thermostat, testing IE rules.	10 lectures
Unit-II	Construction, circuit, intermittent and incipient fault diagnosis and repair of heating appliances; manual and automatic electric iron. Manual and automatic electric kettle, oven, hot plate, immersion water heater, geyser, soldering iron, electric toaster and electric blanket	10 lectures
Unit-III	Principles of illumination-luminous flux, intensity, lumen and luminance, use of luxmeter, Classification of electric lamps-incandescent lamp, fluorescent lamp, mercury vapour, sodium vapour lamp, neon lamp, arc lamp, halogen lamp, CFL, Comparison and applications of lamps, twin tube connection and its use, stroboscopic effect, decorative lamps, principles of operation, power consumption, fault diagnosis.	10 lectures
Unit-IV	Repair of motorized appliances- ceiling fan, table fan, mixer, blower, hair drier, electric sewing machine, refrigerator, electric washing machine, air conditioner etc.	8 lectures
Unit-V	Safety and preventive maintenance fundamentals, IE rules, appliances for hazardous area.	4 lectures
Total lectures		42

Recommended Books:

1. Study of Electrical Appliances and Drives, K.B. Bhatia, Khanna Publishers, New Delhi, 2001
2. How to repair Electrical Appliances, Wheelers, D.B. Taraporewala and sons Co. P. Ltd, Mumbai.
3. Electrician 1st Year Trade Theory, CIMI, New Age International, New Delhi, 1993

EE-2251 Electrical Maintenance Lab- II : 2 Credits (0-0-4)

1. Study of Batteries (Dry cells and secondary cell)
2. Battery charging and testing methods
3. Study and repair of DC motor starters
4. Study of drives for
 - (i) Lathe machines
 - (ii) Compressors
 - (iii) Motorized domestic appliances
5. Study of earthing provision for electrical installation
6. Use of winding machine and winding practice for (i) transformers (ii) small motors
7. Studies of different categories of electrical insulations and megger testing.

Department of Electronics and Communication Engineering

Certificate in Maintenance Engineering (Electronics)

Base Module

Year I						
Semester I						
S.N.	Course Code	Course Title	L	T	P	Credits
1.	HS 1101	English-I	2	0	2	3
2.	PH 1101	Physics-I	4	0	2	5
3.	CY 1101	Chemistry-I	3	0	2	4
4.	MA 1101	Mathematics-I	3	1	0	4
5.	ES 1151	Engineering Drawing-I	0	0	6	3
6.	ES 1152	Workshop Practice	0	0	8	4
Total			23			
Semester II						
S.N.	Course Code	Course Title	L	T	P	Credits
1.	HS 1201	English -II	2	0	2	3
2.	PH 1201	Physics-II	4	0	2	5
3.	CY 1201	Chemistry-II	3	0	2	4
4.	MA 1201	Mathematics-II	3	1	0	4
5.	EC 1251	Electronic Workshop & Drawing	1	0	4	3
6.	ES 1200	Basics of Electrical & Electronics Engg.	4	0	2	5
Total			24			
Year II						
Semester I						
S.N.	Course Code	Course Title	L	T	P	Credits
1.	MA 2101	Mathematics-III	3	1	0	4
2.	EC 2100	Principles of Electronics Circuits and Devices	3	0	2	4
3.	EC 2101	Fundamentals of Telecommunication Engg.	3	0	2	4
4.	EC 2102	Electronic Measuring Instruments	2	0	2	3
5.	EC 2103	Radio Engineering	2	0	4	4
6.	EC 2151	Electronics Workshop II	0	0	5	3
7.	EC 2152	Electronic Servicing & Maintenance I	0	0	5	3
Total			25			
Semester II						
S.N.	Course Code	Course Title	L	T	P	Credits
1.	ES 2200	Basics of Computers and Programming	2	0	2	3
2.	ES 2201	Technical Mechanics	3	1	0	4
3.	EC 2200	TV Engineering	3	0	0	3
4.	EC 2201	Audio System Engineering	2	0	2	3
5.	EC 2251	TV Engineering Lab	0	0	6	3
6.	EC 2252	Electronic Servicing & Maintenance II	0	0	5	3
7.	HS 2201	Entrepreneurship	3	0	0	3
8.	ED 2288	Extracurricular activities and Discipline	0	0	0	2
Total			24			

EC 1251 Electronics workshop & Drawing: 3 Credits (1-0-4)

- Unit I Introduction to all basic tools used in electronic workshop.
- Unit II Symbols of all basic components like relays, Switches, wire jumps and joints.
- Unit III Different types of resistors, capacitors, and inductors.
- Unit IV Drawing of symbols and constructional details of: Resistors, Capacitors, Inductors, Diodes, LED, Transistors, JFET and MOSFET.
- Unit V Introduction to Logic gates.
- Unit VI Familiarization with data sheets
- Unit VII Internal layout diagram of analog and digital ICs
- Unit VIII Internal diagram of the PMMC, moving iron meter.

Recommended Books:

1. Basic Electronics 9 th Edition by Bernald Grob & M E Schultz (TMH)
2. Electronics Source books for Engineers by George Loveday (wheeler Publishing)

EC 2100 Principles of Electronics Circuits and Devices: 4 credits (3-0-2)

Unit I	PN Junction Electronics: Insulators, semiconductors and metals, Mobility and conductivity, Intrinsic and extrinsic semiconductors and charge densities in semiconductors, diffusion and drift current in semiconductors, forward and reverse bias, V-I characteristics, current equation, Zener and its characteristics. Diode Circuits: Diode as a circuit element, Load line concept, dc and ac equivalent circuits. Analysis of Clipper, clamper and multiplier circuits. Half wave, full wave rectifier circuits, Zener diode and LED.	7 lectures
Unit II	Transistors: Basic principles of operation, I/V characteristics, Modes of operation Active, Saturation and cut off, α , β calculations.	10 lectures
Unit III	Amplifier configuration: CE, CB, CC, Biasing of Transistors, Load line and Q point. Introduction to Class A, B and C amplifier circuits. Simple calculation of Voltage/ current gain, Input/ output impedance power amplifier. Introduction to multistage amplifiers.	7 lectures
Unit IV	Oscillators and Multivibrator: Operation principles of Colpitt and Hartley Oscillator. Specifications of other types of oscillators. Astable, Monostable, Bistable multivibrator	8 lectures
Unit V	Introduction to IC: Familiarization with popular ICs like LM 117, 317, 741, 555, 7400/7402/7406, 7805, 7809, 7812, Audio & Video amplifiers.	10 lectures

Recommended Books:

1. Electronic Devices and Circuit theory, 8th ed. by Robert L boylestad and Louis Nashelsky (PHI)
2. Electronics Principles by A.P. Malvino (TMH)
3. Microelectronics by J. Millman and Arvin Gabel.(TMH)
4. Integrated Electronics by J.Millman and C.C Halkias.(TMH)

EC2101 Fundamentals of Telecommunication Engineering.: 4 Credit (3-0-2)

Unit I	Introduction to EM waves and their spectrum. Principles of Radiation	5 lectures
Unit II	Types of EM wave propagation –Ground wave, Sky wave, Space wave propagation. Structure of Ionosphere, Skip distance, Radio horizon, skip zone.	5 lectures
Unit III	Introduction to Transmission lines –Twisted pair wires, coaxial cables and Wave guides	7 lectures
Unit IV	Principles of Amplitude, Frequency and phase Modulation Techniques	8 lectures
Unit V	Introduction to communication systems:Telephony ,Telegraphy ,Radio and TV transmission.	7 lectures
Unit VI	Introduction to Antennas –HF, VHF, UHF and microwave antennas. Introduction to RADAR, Satellite and Optical communication systems.	10 lectures

Recommended Books:

1. An Introduction to Analog and Digital Communication. by Simon Haykin.(John Wiley & Sons)
2. Electronic Communication Systems. by G.Kennedy and Bernard Davis (TMH).
3. Electronics Communication Systems. by Dennis Roody and John Coolen.(PHI).
4. Telecommunications. by S.Ramabhadran.

EC 2102 Electronic Measuring Instruments: 3 Credits (2-0-2)

Unit I	Instruments and Measurement Systems: Definition, application and types of measurements, Instrument classification, Functional elements of an instrument, Standards, Calibration, Standards of measurements.	5 lectures
Unit II	Principle and working of PMMC instruments, moving iron, electrostatic type, electrodynamic type, thermocouple type and rectifier type instruments.	9 lectures
Unit III	Basic measuring meters: Working of voltmeter, ammeter and ohmmeter. Introduction to DVM, Electronic multimeter.	6 lectures
Unit IV	Cathode Ray Oscilloscope: Introduction, Cathode Ray Tube, Electron Gun, Electrostatic focusing, Electrostatic deflection, Deflection Plates. Basic CRO Circuit, Observation of waveform on CRO, Lissajous pattern.	6 lectures
Unit V	Introduction to Signal Generators.	2 lectures

Recommended Books:

1. A Course in Electrical Electronics Measurements and instrumentation by A.K.Sawhney, (Dhanpat Roy & Co.)
2. Modern Electronics Instrumentation and Measurement Techniques by Albert D.Heltrick, W. D. Cooper (PHI.)
3. Instrumentation, Measurement & Analysis by K KChaudhury& R C Nakra, (TMH.)

EC 2103 Radio Engineering: 4 Credits (2-0-4)

Unit-I	AM Transmitter: AM Modulation, Low level and high level modulation, Class C high level plate/collector modulators, Low level grid/base modulators, 1kW Transistor Class C collector modulator. Transmitter antenna, quarter wave and half wave dipoles, horizontal and vertical dipoles mast and top loading.	6 lectures
Unit-II	Aerials and Front stage: Ferrite rod MW band aerial, SW band Loop antenna, antenna coils and associated RF and mixer circuits.	3 lectures
Unit-III	Super heterodyne Radio Receiver: Tuned radio frequency (TRF) and super heterodyne AM receivers, selectivity and sensitivity of receivers, RF & local oscillator and IF frequencies, image frequency and image frequency rejection, Mixer stage, Single sweep capacitor tuning ratio, AGC need and types.	5 lectures
Unit-IV	Transistorized Radio Circuit: Over all transistorized 3 band radio receiver circuit assembly, tracking and alignment techniques, testing and repair and servicing methods of detector, volume control pot cum on/off switch, dc/ac fed power supply sections and audio stages.	5 lectures
Unit-V	Radio Bands: MW and SW ₁ , SW ₂ radio wave bands, Band changer- Switches, Push button switch, construction assembly and repair.	4 lectures
Unit-VI	FM radio Receiver: Basics principles of FM reception, FM frequency bands, FM band intermediate frequency, FM detection methods.	5 lectures

Recommended Books:

1. Radio Engineering. by G.K.Mithal and Ravi Mittal.(Khanna Pub.).
2. Electronic Communication Systems. by George Kennedy. (TMH).
3. Electronics Communication Systems. by Dennis Roody and John Coolen.(PHI).
4. Basic Radio and Television, by S.P.Sharma. (TMH)

EC 2151 Electronic workshop-II : 3 credits (0-0-5)

Unit-I	Soldering Practice.
Unit II	Designing inductors of desired value.
Unit III	Testing of Diodes, Transistors and JFETS using ohmmeter method,
Unit IV	Testing of Logic gates. Transformer winding. Fixed and variable power supply design
Unit V	PCB Design: Design rules, Manual and CAD based .
Unit VI	Repairing of speakers, Baffle design.
Unit VII	Study of internal block diagram of pre amplifier and audio power amplifiers.
Unit VIII	Design and assembly of a small electronic gadget.

Recommended Books:

1. Electronics Sourcebook for engineers by George Loveday. (Wheeler publishing)
2. Printed Circuit Board: Design and Technology by W C Bosschart.

EC 2152 Electronic servicing & Maintenance-I : 3 Credits (0-0-5)

Unit-I	Maintenance and servicing of dc power supply.
Unit II	Maintenance and servicing of SMPS, UPS and inverter.
Unit III	Maintenance and servicing of PMMC and Moving Iron Ammeter and voltmeter.
Unit IV	Maintenance and servicing of Analog Multimeter, DVM and Digital Multimeter.
Unit V	Maintenance and servicing of Variac and transformer.

Recommended Books:

1. Electronic Troubleshooting by Daniel R Tomal, Neal Widmer, T. Daniel. (TMH)
2. Troubleshooting Electronic Equipment by R S Khandpur (TMH)
3. Electronic Servicing and Repairs by Trevor Linsley, Newnes.

EC 2200 Television Engineering: 3 Credits (3-0-0)

Unit-I	Introduction: Introduction to various Television systems, Elements of TV Communication – Nature of picture signals, line and field frequency, Sequential and Interlace scanning, Synchronization and Blanking pulses, equalization pulses, horizontal and vertical resolution, composite video signal, Band width of picture signal.	9 lectures
Unit-II	Television Cameras and Picture Tube: Principle of operation, construction and working of Monochrome and CTV, Delta gun and PIL Picture tubes Image orthicon, vidicon, plumbicon camera tubes.	7 lectures
Unit-III	Transmitter: Modulation systems used in sound, picture, and colour signals and various transmitters, Channel band width allocations, vestigial side band transmission. DSBSC transmission, block diagram of transmitter and receiver.	7 lectures
Unit-IV	Monochrome TV Receiver circuits: Various stages of the B/W TV receiver set such as TV tuners, IF stage, keyed AGC, keyed and delayed AGC, sound separators, various trap circuits, inter carrier sound stage and audio and video amplifier stages.	11 lectures
Unit-V	Colour T.V. and Applications: Operation of colour T.V., compatibility requirements, colour, Hue, saturation and luminance, colour signal generation, colour picture tubes colour television systems, N.T.S.C., PAL and SECAM systems and their comparison, colour difference signals, colour diagram, synchronous quadratic modulation, Colour TV Receiver, video CD recording, digital T.V. receiver. HDTV, Concept of plasma and LCD screen, computer monitors.	8 lectures

Recommended Books:

1. Television and Radio Engineering. by Arvind M. Dhake. (TMH).
2. Monochrome and Colour Television. by R.R.Gulati. (Wiley Eastern)
3. Monochrome and Colour Television. Practice by R.R.Gulati. (Wiley Eastern)
4. Basic Radio and Television. by S.P.Sharma. (TMH)

EC 2201 Audio System Engineering: 3 Credits (2-0-2)

Unit I	Microphones- Basic principles, various types and their applications	3 lectures
Unit II	Loudspeakers- Basic principles, various types and their applications	3 lectures
Unit III	Audio Systems: Acoustics, vibration, loudness, pitch and sound quality of the sound wave. High fidelity and high quality sound	5 lectures
Unit IV	Design considerations of Public address systems	3 lectures
Unit V	Sound Recording Systems- Tape mono and stereo, Compact Discs and DVD recording systems and components. Various equalization Techniques	6 lectures
Unit VI	Surround Sound, Movie Sounds-DTS (Digital Theater Systems), Different Dolby Surround types ProLogic, 5.1, AC-3 (Dolby's third audio-coding design), SR-D (Spectral Recording Digital), 8 channel SDDS (Sony's Dynamic Digital Sound)	9 lectures
Unit VII	Advances in Audio Systems and Sound Cards	3 lectures

Recommended Books:

1. Audio Video System Principle, Maintenance and Troubleshooting by R.G.Gupta. (TMH).
2. Sound and Recording-An Introduction by Francis Rumsey and Tim McCormic (Focal Press)
3. Sound System Engineering, Don Davis and Eugene Patronis (Focal Press)
4. Fundamentals of Audio and Video Systems. M.L. Anand. (Khanna Pub.)

EC 2251 T.V. ENGG LAB : 3 Credit (0-0-6)

Unit-I	Study of monochrome and colour TV Kits
Unit-II	Study of TV circuit diagram, familiarization of different stages and their tracing. Tracing, study of pattern generators and wave form analysis.
Unit-III	Demonstration of video IF alignment. Voltage measurements at different test points.
Unit-IV	Study and demonstration of tuner alignment and linearity adjustment, demonstration of horizontal and vertical Oscillator alignment. Study of tuner for different channels.
Unit-V	Study and repairing of computer monitor.

Recommended Books:

1. Radio Engineering. by G.K.Mithal and Ravi Mittal. (Khanna Pub.).
2. Electronic Communication Systems. by George Kennedy. (TMH).
3. Electronics Communication Systems. by Dennis Roody and John Coolen. (PHI).
4. Basic Radio and Television. by S.P.Sharma. (TMH)

EC 2252 Electronic Servicing & Maintenance –II : 3 Credits (0-0-5)

Unit I	Servicing and maintenance of voltage stabilizer
Unit-II	Servicing and maintenance of AM signal generator, FM signal generator and CRO.
Unit III	Servicing and maintenance of TV, DTH/STB, CD & DVD players.
Unit IV	Servicing and maintenance of telephone receiver, mobile phone and cordless phone sets.

Recommended Books:

1. Troubleshooting and Repairing Major Appliances by Kleinert, Eric, TabBooks
2. Major Appliances: Operation, Maintenance, Troubleshooting and Repair by Langley, Billy C, Prentice Hall.

Department of Mechanical Engineering

Programme : Certificate in Maintenance Engineering (Mechanical)

Year I						
Semester I						
S.N.	Course Code	Course Title	L	T	P	Credits
1.	HS 1101	Remedial English	2	0	2	3
2.	PH 1101	Physics-I	4	0	2	5
3.	CY 1101	Chemistry-I	3	0	2	4
4.	MA 1101	Mathematics-I	3	1	0	4
5.	ES 1151	Engineering Drawing	0	0	6	3
6.	ES 1152	Workshop Practice	0	0	8	4
		Total	12	1	20	23
Semester I						
S.N.	Course Code	Course Title	L	T	P	Credits
1.	HS 1201	English Language & Communication	2	0	2	3
2.	PH 1201	Physics-II	4	0	2	5
3.	CY 1201	Chemistry-II	3	0	2	4
4.	MA 1201	Mathematics-II	3	1	0	4
5.	ME 1251	Mechanical Drawing	1	0	4	3
6.	ES 1200	Basic Electrical & Electronics Engineering	4	0	2	5
		Total	17	1	12	24
Year II						
Semester I						
S.N.	Course Code	Course Title	L	T	P	Credits
1.	MA 2101	Mathematics-III	3	1	0	4
2.	ME 2101	Mechanical Sciences	3	0	0	3
3.	ME 2151	Materials & Shop Theory	2	0	6	5
4.	ME 21**	Trade Theory –I	3	0	0	3
5.	ME 21**	Trade Theory –II	3	0	0	3
6.	ME 21**	Trade Practice –I	0	0	4	2
7.	ME 21**	Trade Practice –II	0	0	6	3
		Total	14	1	16	23
Semester II						
S.N.	Course Code	Course Title	L	T	P	Credits
1.	HS 2201	Entrepreneurship	3	0	0	3
2.	ES 2200	Basics of Computers & Programming	2	0	2	3
3.	ME 2201	Engineering Mechanics	4	1	0	5
4.	ME 2202	Machine Maintenance	3	0	2	4
5.	ME 22**	Trade Theory –III	3	0	0	3
6.	ME 22**	Trade Practice –III	0	0	4	2
7.	ME 22**	Trade Practice –IV	0	0	4	2
8.	ME 2279	Vocational Training#	-	-	-	2
9.	ED 2288	Extra Curricular Activities	-	-	-	2
		Total	15	1	12	24+2(ED)

Vocational training is to be taken up during winter break for 2 WEEKS

	Trade Course codes and names		
	RAC Trade	Automobile Trade	Craftsmanship Trade
Trade Theory - I	ME 2111: Basic Refrigeration and Air Conditioning	ME 2114: Automobile Servicing I	ME 2117 : Machine elements and Machine Tools
Trade Theory - II	ME 2112 : RAC Equipments	ME 2115: Automobile Servicing II	ME 2118 : Sheet Metal, Carpentry & Welding
Trade Practice - I	ME 2161 : RAC Practice I	ME 2164: Auto. Serv. Practice I	ME 2167: Craftsmanship Practice I
Trade Practice - II	ME 2162 : RAC Practice II	ME 2165: Auto. Serv. Practice II	ME 2168: Craftsmanship Practice II
Trade Theory - III	ME 2211: RAC Systems	ME 2214: Automobile Servicing III	ME 2217 : Foundry, Forging & Forming
Trade Practice - III	ME 2261: RAC Practice III	ME 2264: Auto. Serv. Practice III	ME 2267: Craftsmanship Practice III
Trade Practice - IV	ME 2262 : RAC Practice IV	ME 2265: Auto. Serv. Practice IV	ME 2268: Craftsmanship Practice IV

Courses offered to branches other than ME

ME	2121	Workshop Theory & Practice	2	0	4	4	AE (TM)
ES	2201	Technical Mechanics	3	1	0	4	AE, CE, EE & EC

COURSE CONTENTS

ES 1151 Engineering Drawing : 3 Credits (0-0-6)

Drafting Principles: Manipulation and use of drawing equipments and instruments; Lines, lettering and dimensioning.

Geometrical Drawing: Construction of diagonal Scales. Geometrical drawing of regular polygons, Ellipse, parabola, hyperbola and various engineering curves like cycloid, epicycloids, hypocycloid, involutes, logarithmic spirals.

Projections: First angle & third angle projections, orthographic and oblique projections, projections of points, straight lines, planes and solids.

Sectional views: Sections of solids. Half section, full section and skin section views, sectional views of intersection of surfaces.

Surface development: Development of surfaces like box, cylinder, cone, pyramids.

Civil and electrical Engineering drawing: Introduction to building drawing & Electrical circuit drawing; Symbols

Recommended Books

1. Elementary Engineering Drawing, N.D. Bhatt, Charotar Publishing House, 1992.
2. Engineering Drawing practice for schools and colleges (SP:46-1988).
3. Machine Drawing, N. Siddeswar, Tata McGraw Hills, 2000.

ES 1152 Workshop Practice: 4 Credits (0-0-8)

(Carpentry 0-0-2; Fitting 0-0-2; Sheet Metal/machine shop 0-0-2; Welding 0-0-2)

Introduction to safety aspects in workshop and different tools (functions, types and specifications) used in different shops.

Carpentry Shop: Introduction to woodworking, kinds of woods, hand tools and wood working machines, simple joints and wood turning.

Fitting Shop: Introduction to fitting shop tools (functions, types and specifications), equipment and operations, fitting jobs.

Sheet Metal/Machine Shop: Sheet metal tools (functions, types and specifications) and sheet metal jobs/ Familiarization of lathe, shaper & milling machines, demonstration of machine tool operation.

Welding Shop: Introduction to gas and arc welding tools, equipments and processes, soldering, brazing and welding practice, job preparation by welding.

Recommended Books

1. Elements of workshop technology / Vol. 2, Machine tools, S. K. Choudhury, H. Choudhury, S. C. Bhattacharya and S. K. Bose, Asia Pub. House, 1967.
2. Shop theory, E. Tatro, James Anderson, Tata McGraw-Hill Education Pvt. Ltd., 2004

ME 1251 Mechanical Drawing: 3 Credits (1-0-4)

Unit I	Introduction to I.S. codes, limits, fits and tolerances, conventional drawing symbols, surface finish, materials, abbreviations in drawing, machine components, welding symbols, instruments symbols.	3 lectures
Unit II	Isometric and orthographic projections, missing views, surface development, free hand sketching.	4 lectures
Unit III	Assembly elements: screw threads, bolts & nuts, studs, screw, keys, springs.	3 lectures
Unit IV	Sectional views-half, full, partial, and aligned sectioning, Parts listing; drawing vs. manufacturing processes, reading of drawing, study of machine drawings, automobile parts.	4 lectures

Recommended Books:

1. Machine Drawing, K.L. Narayana, P. Kannaiah & K. Venkata Reddy, New Age Int. Pub., 3rd Ed., 2014
2. Machine drawing, N. Siddeswa & P. Kannaiah, McGraw Hill, Int. 2nd Ed., 2010
3. Production Drawing, K.L. Narayana, P. Kannaiah & K. Venkata Reddy, New Age Int. Pub., 3rd Ed., 2014

ME 2101: Mechanical Science : 3 Credits (3-0-0)

Unit I	Terminology of Refrigeration & Air Conditioning, system and surroundings, equilibrium state; Internal and external energy, sensible & latent heat, work done, Enthalpy & entropy. Representation of enthalpy, entropy in graphical forms, use of p-h Charts, Introduction to psychrometry, psychrometric properties, Dalton's law of partial pressure, adiabatic saturation temperature, introduction to psychrometric chart and psychrometers.	11 lectures
Unit II	Automobile and its development, classification, Layout, main components and assemblies of automobiles. Tools and Gauges used in automobiles, Fasteners and Gaskets. Introduction of I.C. engine and Steam engine, operating principle of CI engine and SI engine, Two stroke and four stroke engines, comparison between SI engine and CI engine, valve timing diagram. Automobile fuels & their characteristics.	11 lectures
Unit III	Introduction to various machine tools, Machine tool classifications, specifications etc. Principles of metal cutting and machine tools – Lathe, shaping machine, milling machine, Grinding machines & drilling machines (Brief functions, types, operations, major parts/components/systems).	9 lectures
Unit IV	Carpentry: Selection of timber for different types of wood works, Seasoning of timber, Methods of seasoning, Common defects in timber, Qualities of good timber, Market sizes of timber. Auxiliary materials used in carpentry: nails, dowels, screws, bolts, nuts, glue, paints, varnishes.	5 lectures
Unit V	Various metal forming processes: Drawing, Extrusion; Engraving and embossing; Piercing, Blanking and Coining; Upsetting, bending & stretching; Simple calculations on metal forming processes. Sheet metal operations: Cutting (manual & mechanical); Joints; Riveting and soldering; Design & development of sheet metal jobs; Ducts & exhaust systems and other examples: design and manufacture.	6 lectures

Recommended Books:

1. Basic Refrigeration and Air Conditioning, P. N. Ananthanarayanan, Tata McGraw Hill, 4th Ed., 2015.
2. Principles of Refrigeration, R. J. Dossat, Pearson Education, 4th Ed., 2002.
3. Refrigeration and Air conditioning, C.P. Arora, Tata McGraw Hill, 2002.
4. Automobile Engineering, G. B. S. Narang, Khanna Publishers, 5th Ed., 2011.
5. Automobile engineering (Vol I & II), Kirpal Singh, Standard Publishers & Distributors, 13th Ed., 2012.
6. Elements of Workshop Technology (Vol I & II), S. K. Choudhury and Hazra Choudhury, Media Publishers & Promoters, 1st Ed., 2010.

ME 2151 Materials and Shop Theory: 5 Credits (2-0-6)**(Practice : Machine Shop / Pattern making / Smithy – 2 hrs each)**

Unit I	Engineering Materials: Classification of materials, general properties of material. Ferrous material, system of designation of Iron and steel, IS codes, specification of structural /heat treatable steels. Standard sizes of hot rolled products, symbolic designation of essential properties of materials (I.S. practice), Tool and Die steels, color codes of steel.	6 lectures
Unit II	Non-ferrous material, Copper and its alloys, color code for copper alloys (IS 2376-1963), Aluminum and its alloys. Zinc and its alloys. Standard sizes and shapes of materials available in the market as per IS codes. Other standard practices like, ASME, BIS. Demonstrations of Estimating engineering properties of materials. Non metals and their applications in engineering practices; Engineering Plastics, their properties and applications, IS codes for plastics. Fibers; Ceramics and composites.	9 lectures
Unit III	Introduction to safety measures in workshops; Different types of cutting tools used in different machine tools; Tool geometry. Construction & operation of machine tools. Selection of cutting speeds and feeds etc. for basic machine tools e.g., lathe, drilling machine, shaping machine, milling machine and grinding machine. Shop calculations	7 lectures
Unit IV	Engineering Components: Limits and fits, terminology for ISO system, IS symbols, bolts, nuts, and other fasteners, IS codes for fasteners, threads, IS codes, measurement of thread profile, pitch, height etc., standard bolts, nuts, washers, rivets, pins, key selection of fasteners, self-holding tapers, use of self-holding tapers.	6 lectures

Laboratory breakups :

Machine shop practice	Principal parts of tool, tool geometry, demonstration on lathe, its various parts & functions, job & tool holding procedure, operational aspects, simple jobs involving plain turning, step turning, taper turning and facing, practice in shaping machine, drilling machine, milling machine and grinding machine, calculation of cutting speed, material removal rate and machining time.	28 hours
Pattern making practice	Introduction, practice on pattern making, core box making, solid pattern, split pattern, practice on melting, moulding and core making, sand casting methods, casting of given items, grain fineness number and permeability number determination.	28 hours
Smithy shop practice	Introduction to fitting and safety aspect, use of different tools (functions, types and specifications), practice simple fitting jobs, different tools & their uses, standard material available for smithy works, manufacturing chisel and hexagonal bolt, chain link manufacturing, practice in forging operation, drawing, upsetting & swaging punching.	28 hours

Recommended Books:

1. Elements of Workshop Technology, Vol I & II, S. Kumar, H. Choudhury and S.K. Bose, Bombay: Media Promoters & Publishers PVT Ltd., 3rd Ed., 1978.
2. Shop Theory, J. Anderson & E. Tatro, Tata McGraw-Hill, 6th Ed., 1990.
3. Manufacturing Technology: Foundry, Forming and Welding, P.N. Rao, Tata McGraw Hill, 3rd Ed., 2014.
4. Principles of Manufacturing Materials and Processes, J.S. Campbell, Tata McGraw Hill, 1961.

ME 2201 Engineering Mechanics: 5 Credits (4-1-0)

Unit I	Mechanics and its relevance to engineering, inertia and moving frames of reference, free body diagram, internal and external forces, force systems; laws of mechanics, concept of moment, equilibrium principle, equilibrium of concurrent and coplanar force systems; equilibrium of bodies in space.	10 lectures
Unit II	Simple structures: Types of structures, supports & reactions, analysis of structures, method of joints, method of sections, forces in members of a frame.	9 lectures
Unit III	Static analysis of systems with friction: friction and impending motion, wedge friction, rolling resistance, sliding and rolling of cylinders, friction in motion analysis, friction in belt-pulley system, wheel friction in automobiles, friction in road skates & ice skates.	9 lectures
Unit IV	Area, mass & volume distribution of matter, centroid, centre of mass, centre of gravity and centre of volume, Concepts of first moments and second moments; Centroid of length, centroid of an area and centroid of a volume, Theorem of Pappus and Guldinus, Moment of Inertia: parallel axes theorem and perpendicular axis theorem. Moment of inertia of composite sections.	9 lectures
Unit V	Kinematics of Rigid Body: types of motion, fixed axis rotation, plane motion of a rigid body, resolution and composition method of velocity analysis, instantaneous centre of rotation, relative velocity and acceleration for points on a rigid body, Coriolis acceleration.	9 lectures
Unit VI	Dynamics of a Rigid Body: D'Alembert's principle, translation of a rigid body, rotation of a rigid body about a fixed principal axis, plane motion of a rigid body, general motion of a rigid body. Projectiles and SHM; Impact of Two Bodies: Co-efficient of restitution, plane centre of collision, collision of a small body with massive body. Work power and energy principles.	10 lectures

Recommended Books:

1. Engineering Mechanics: Statics and dynamics, H. Shames, 4th Ed, PHI, 2002.
2. Vector Mechanics for Engineers, Vol I - Statics, Vol II – Dynamics, F. P. Beer and E. R. Johnston, 9th Ed, Tata McGraw Hill, 2011.
3. Engineering Mechanics, Vol I – Statics, Vol II – Dynamics, J. L. Meriam and L. G. Kraige, 6th Ed, John Wiley, 2008.
4. Engineering Mechanics: Principles of Statics and Dynamics, R. C. Hibbeler, Pearson Press, 2006.
5. Introduction to Statics and Dynamics, Andy Ruina and Rudra Pratap, Oxford University Press, 2011.
6. A Textbook of Engineering Mechanics, Dr. R.K. Bansal, Sanjay Bansal, Laxmi Publication, 2015.

ME 2202 Machine Maintenance : 4 Credits (3-0-2)

Unit I	Introduction to maintenance engineering, breakdown maintenance and preventive maintenance, classification of machines based on maintenance, repair cycle of various machines, repair complexity, depreciation and machine life.	10 lectures
Unit II	Periodic maintenance of machine tool components like tailstock, three jaw chuck, lead screw and nut, machine spindles and guide surfaces.	10 lectures
Unit III	Limits, fits and tolerances, threads and threaded joints, gears and gear transmission, gear trains, heat treatment of materials.	8 lectures
Unit IV	Accessories of lathe, drilling machines, shaping machine and milling machine.	6 lectures
Unit V	Pumps, compressors, engines, valves, piping systems, machine hydraulics.	8 lectures
Practice	Repair of various machine tool components: disassembly, maintenance and assembly of machine parts as per given specifications, fabrication of small components for maintenance of machine parts.	28 hours

Recommended Books:

1. Industrial Maintenance, H.P.Garg, S.Chand & Company Limited, 6th Ed., 2008.
2. Maintenance Engineering Handbook, R.K.Mobley, Mc-Graw Hill Education, 8th Ed., 2014.
3. Plant Equipment and Maintenance Engineering Handbook, D.C.Richardson, Mc-Graw Hill Education, 2014
4. Elements of Workshop Technology, Vol I & II, S. Kumar, H. Choudhury and S.K. Bose, Bombay: Media Promoters & Publishers PVT Ltd., 3rd Ed., 1978.
5. Shop Theory, J.Anderson & E. Tatro, Tata McGraw-Hill, 6th Ed., 1990.

ME 2279 : Vocational Training : 2 Credits

The training is carried out at an industry for familiarizing with practices followed in an industry of the chosen specialized area. Evaluation is based on the training report submitted (60% weightage and seminar 40% weightage)

First week: Training various sections of the industry, study and preparation of training report at an industry

Second week: Specialised training one section, study of various machines or systems and report preparation at the industry

Detail report: A detailed written report is to be submitted to the training Coordinator, Dept of Mechanical Engg. for evaluation after return from training

Presentation: Seminar presentation on the training on the specified date and time for evaluation

TRADE COURSES**Trade: REFRIGERATION AND AIR CONDITIONING (RAC)****Trade Theory – I: ME 2111: Basic Refrigeration and Air Conditioning: 3 Credits (3-0- 0)**

Unit I	Method of refrigeration – Ice, dry Ice, using liquid gas, evaporative, by expansion of air, by throttling of gas. Unit of refrigeration, refrigeration systems, Line diagram – vapour refrigeration system, absorption refrigeration system, steam jet refrigeration system, Bell-Coleman air refrigeration system, boot-strap air refrigeration system, air conditioning system of airplane. vapour compression cycle, T-S and P-H charts, sub cooling, super heating and its effect on COP.	8 lectures
Unit II	Air refrigeration cycle, application and limitations. Carnot cycle and reverse Carnot cycle. Energy balance of a refrigeration machine–heat absorbed from the system, heat rejected to surrounding and work done. COP, Comparison of heat engine, heat pump and refrigeration machine.	6 lectures
Unit III	Refrigerants and their properties, nomenclature- R 11, R 12, R 22, R 502, R113, R 114, ammonia and carbon dioxide, application pressure of refrigerants in different systems, oil miscibility, solubility in water, secondary refrigerant, Brines and glycols.	6 lectures
Unit IV	Psychrometric processes: sensible cooling and heating, humidification and dehumidification, cooling with humidification / dehumidification, heating and humidification, chemical dehumidification, heating and humidification, latent and sensible heat determination involved in the processes, sensible heat factor, bypass factor, mixing of air streams, evaporating cooling, air washer.	8 lectures

Unit V	Environment and human health, concept of comfort, effective temperature, comfort chart, comfort zones. Principle of load estimating, cooling and heating loads, factors affecting load estimation, components of load, internal and external system heat gain, infiltration, ventilation, air cleaning, cooling load estimation.	7 lectures
Unit VI	Air distribution systems – functions, components, air handling unit, duct systems and construction, principles of air flow in duct, pressure in ducts – static pressure, velocity pressure and total pressure, friction losses, duct sizing methods, duct layout and measurement of air velocity and flow.	7 lectures

Recommended Books:

1. Basic Refrigeration and Air Conditioning – P. N. Ananthanarayanan, Tata McGraw Hill, 4th Ed., 2015.
2. Principles of Refrigeration – Roy J. Dossat, Pearson Education, 4th Ed., 2002.
3. Refrigeration and Air conditioning – C.P. Arora, Tata McGraw Hill, 2002.
4. Refrigeration and Airconditioning – P. L. Ballaney, Khanna Publishers, 2003.
5. A Textbook of Refrigeration and Air-Conditioning – R. K. Rajput, S.K. Kataria & Sons, 2013.

Trade Theory - II: ME 2112: Refrigeration and Air Conditioning Equipments: 3 Credits (3-0-0)

Unit I	Refrigeration tools and materials: Tubing and piping materials and their specifications, copper tube practices – cutting, bending, flaring, swaging, brazing, pinching, tube and pipe fittings, instrument and gauges, different types of valves, gaskets, refrigerant cylinders and their handling, human safety.	6 lectures
Unit II	Compressors: Type of compressor - reciprocating (Semi hermetic, hermetic and open types), rotary, centrifugal and screw type, compressor construction, p – V diagram of compressor, working of compressor, volumetric efficiency of compressor, lubrication of compressor, Cooling of compressor and windings, mufflers.	7 lectures
Unit III	Throttling or expansion devices: Types of expansion devices, construction and operation of automatic and thermostatic expansion valves, capillary tubes, float valves, testing and adjusting thermostatic expansion valves, solenoid valves, electronic TEV.	7 lectures
Unit IV	Condensers: Types of condensers – air cooled, water cooled and evaporative, condensing temperature, condenser load, heat rejected factor, fouling of condenser, use of cooling tower in condenser. Evaporators: functions and types of evaporators - dry and flooded, bare and finned type, heat absorbed in evaporators, chillers, different types of chillers method of defrosting. Other components: receivers, accumulators, driers.	8 lectures
Unit V	Air Conditioner Components: functions and classification of fans, filters, humidifiers, ducts, grills, resistors, dampers, turning vanes, anemometer, hygrometer etc.	7 lectures
Unit VI	Controls: functions and elements of control, Sensing elements-bimetallic, bulb and bellow, solenoids, electric resistance type etc. actuating element thermostat, humidistat, pressure stats etc., modulating motors, construction and operation, bypass controls, use of chokes for controlling fan motor speeds. Starter capacitors, HP and LP controls, oil failure safety switches, power element testing.	7 lectures

Recommended Books:

1. Basic Refrigeration and Air Conditioning, P. N. Ananthanarayanan, Tata McGraw Hill, 4th Ed., 2015.
2. Principles of Refrigeration, R. J. Dossat, Pearson Education, 4th Ed., 2002.
3. Refrigeration and Air conditioning, C.P. Arora, Tata McGraw Hill, 2002.
4. Air Conditioning Principles and Systems, Edward G. Pita, Pearson Education, 3rd Ed., 1998.

Trade Practice – I: ME 2161 Refrigeration & Air Conditioning Practice I: 2 Credits (0-0-4)

- 1 Introduction to different tools.
- 2 Safety and precautions in workshop.
- 3 Cutting and pinching of copper tube.
- 4 Bending of copper tube.
- 5 Flaring and swaging of copper tube.
- 6 Brazing of copper tube.

- 7 Internal threading of copper and MS pipe.
- 8 External threading of MS and GI pipe.
- 9 Study of different GI pipe joints.
- 10 Practices on riveting sheet metal.
- 11 Practices on surface finish and painting
- 12 Gasket cutting practice.

Recommended Books:

1. Refrigeration and Air Conditioning – R. C. Arora, PHI, 2010.
2. Practical Refrigeration and Air conditioning – M. Adithan & S. C. Laroia, New Age International, 2011.
3. Basic Refrigeration and Air Conditioning – P. N. Ananthanarayanan, Tata McGraw Hill, 4th Ed., 2015.
4. Air Conditioning Principles and Systems - Edward G. Pita, Pearson Education, 3rd Ed., 1998.

Trade practice – II: ME 2162 Refrigeration & Air Conditioning Practice II:

3 Credits (0-0-6)

1. Study of instruments – pressure gauge, anemometer, sling psychrometer, hygrometer, pitot tube, energy meter, multi meter, etc.
2. Study and testing – thermostat, condenser, evaporator, thermostatic expansion valve, automatic expansion valve, low and high pressure cut outs, etc.
3. Disassembly, assembly and study of open type compressor, hermetically sealed compressor
4. Study and testing of capacitors, relays, overloads, chokes.
5. Determine the properties of air using sling psychrometer.
6. Determine the dew point temperature.
7. Determine the relative humidity of air using hygrometer.
8. Determine the velocity of air using anemometer.
9. Determine the velocity, mass and volume flow rate in the duct.
10. Determine the sensible and latent heat flow through a duct.
11. Determine the specific and relative humidity of air flow through the duct.
12. Job – Fabrication of simple components of RAC systems.

Recommended Books:

1. Refrigeration and Air Conditioning, R. C. Arora, PHI, 2010.
2. Practical Refrigeration and Air conditioning, M. Adithan and S. C. Laroia, New Age International, 2011.
3. Basic Refrigeration and Air Conditioning, P. N. Ananthanarayanan, Tata McGraw Hill, 4th Ed., 2015.
4. Air Conditioning Principles and Systems, Edward G. Pita, Pearson Education, 3rd Ed., 1998.

Trade theory – III: ME 2211: Refrigeration and Air Conditioning Systems: 3 Credits (3-0-0)

Unit I	Classification of refrigeration : domestic, commercial, industrial, transport and marine refrigeration systems; Different freezing methods – sharp freezing, quick, immersion, air blast freezing, etc. Study of domestic refrigerator, water cooler, ice maker, cold storage, ice cream maker, dairy refrigeration, freeze drying etc.	6 lectures
Unit II	Classification of air conditioning systems: comfort and industrial air conditioning, unitary and central air conditioning, all air and all water system Study of window type, package units, split unit, desert cooler, central airconditioning systems, car air conditioning, etc.	6 lectures
Unit III	Transport air conditioning – automobile, railway, aircraft air conditioning. Other applications of refrigeration and air conditioning – textile industry, breweries, concrete dams, metal treatments, gas liquefactions, etc.	6 lectures
Unit IV	Evacuation and dehydration – methods, importance; different types of leak detection methods; methods of charging.	8 lectures
Unit V	Commissioning and evaluation of system performance. Preventive maintenance of system and its components such as compressor, condenser, evaporators, etc.	8 lectures
Unit VI	Troubleshooting and breakdown maintenance of refrigeration and air conditioning systems, diagnosis and rectification of faults in electrical system, case study.	8 lectures

Recommended Books

1. Basic Refrigeration and Air Conditioning, P. N. Ananthanarayanan, Tata McGraw Hill, 4th Ed., 2015.
2. Refrigeration and air conditioning, S. C. Arora & S. Domkundwar, Dhanpat Rai & Sons, 2nd Ed., 1974.
3. Principles of Refrigeration, R. J. Dossat, Pearson Education, 4th Ed., 2002.
4. Refrigeration and air conditioning, Manohar Prasad, New Age International, 3rd Ed., 2015.

Trade practice-III: ME 2261 Refrigeration & Air Conditioning Practice III: 2 Credits (0-0-4)

1. Study of domestic refrigerator, water cooler, Window air conditioners, split units etc.
2. Electrical practices – wiring, soldering
3. Practices on evacuation and dehydration, leak detection, charging etc.
4. Repair and service condenser and evaporator.
5. Study of pressure drops in ducts
6. Repairing of hermetically sealed units
7. Complete servicing of a refrigerator
8. Complete servicing of an air conditioner.
9. Fault detection
10. Adjusting the automatic system
11. Wiring diagrams of an air conditioner and central plants.
12. To test safety and operating controls such as relay, thermostat, HP and LP Cut out, over load protector, solenoid valve, oil pressure, Failure control etc.
13. To carry out electric wiring of refrigerator bottle cooler
14. To carry out electric wiring of window type air conditioner.

Recommended Books:

1. Air Conditioning Principles and Systems, Edward G. Pita, Pearson Education, 3rd Ed., 1998.
2. Practical Refrigeration and Air conditioning, M. Adithan & S. C. Laroia, New Age International, 2011.
3. Basic Refrigeration and Air Conditioning, P. N. Ananthanarayanan, Tata McGraw Hill, 4th Ed., 2015.
4. Refrigeration and air conditioning, Manohar Prasad, New Age International, 3rd Ed., 2015.

Trade practice - IV: ME 2262 Refrigeration & Air Conditioning Practice IV: 2 Credits (0-0-4)

Preparation of troubleshooting charts for major components of Refrigeration systems and Air Conditioning Systems. Students will be deputed to work in the relevant laboratories, cells to check the health and status of refrigerators and air conditioners in different laboratories/cells and use the troubleshooting charts, industrial visits.

Trade: AUTOMOBILE SERVICING**Trade Theory-I : ME 2114 Automobile Servicing-I : 3 Credits (3-0-0)**

Unit I	Frame and Suspension: Chassis classification based on layout of power system locations and drive, constructional details of various types of frames, functions. Principles of suspension system, front and rear suspension system, function and types of torque rod, springs and shock absorbers. Maintenance of chassis, frames, springs and shock absorber.	8 lectures
Unit II	Power transmission: Clutch, Function, principles of operation and main components of clutch, types of clutches, clutch lining material. Principles of gearing, types of gear box and their functions, propeller shaft, Universal joint, differential, rear axle, Worm and worm wheel, Straight bevel gear, Spiral bevel gear and hypoid gear final drives.	10 lectures
Unit III	Steering and Front axle: Constructional details and classification of front axle. Front wheel geometry viz. Castor, Camber, King pin inclination, Toe-in. Conditions for true rolling motion of wheels during steering, steering geometry, Ackerman and Davis steering system. Constructional details of steering linkages. Different types of steering gear boxes. Steering linkages and layouts, power and power assisted steering. Wheels and Tyres: Types of wheels, rims, tyres and tube. Constructional and working details of tyres and their selection, ordinary, radial and tubeless tyres, Wear of tyres-cause and remedy, wheel balancing.	12 lectures
Unit IV	Braking systems: Classification of brakes, drum brakes and disc brakes, constructional details, introduction to hydraulic brake, parking brake, vacuum assisted hydraulic brakes, compressed air assisted brakes, leading and trailing brake shoes, working of master cylinders, wheel cylinders, brake pedal adjustment.	6 lectures
Unit V	Hydrodynamic Drive: Fluid coupling: Principle of operation, constructional Details. Torque Converter: Principle of operation, constructional details, performance characteristics, converter coupling.	6 lectures

Recommended Books:

1. Fundamentals of vehicle dynamics, Thomas D. Gillespie, Society of Automotive Engineers, 1992

2. Automotive Mechanics, Joseph Heitner, 2nd Ed (2004) , CBS
3. Automotive Mechanics, Crouse and Anglin, 10th Ed (2006) Special Indian Edition, Tata McGrawHill
4. Automobile engineering (Vol. - I & II) – Kirpal Singh, Standard Publishers.

Trade Theory – II : ME 2115 Automobile Servicing – II: 3 Credits (3-0-0)

Unit I	Engine Construction: Two stroke and four stroke engine construction, cylinder, cylinder head, piston, piston ring, crank shaft, crank pin, connecting rod, Fly wheel, valve mechanism, tappet clearance, end bearing. Bore and stroke, piston displacement, compression ratio, volumetric efficiency, Maintenance of the engine.	10 lectures
Unit II	Combustion and engine performance: combustion on SI and CI engine, knock in CI and SI engine, Cetane and Octane number, Air-fuel ratio, choking, Supercharging and Turbo-charging. Engine performance analysis, power, torque and speed of engine, calculations. Morse test.	10 lectures
Unit III	CI Engine Fuel system: Air and solid injection, function of components, injector Fuel injector-types of injection nozzle, injection timing. SI Engine Fuel System: Carburetor working principle, Fuel feed systems. Mechanical and Pneumatic governors.	10 lectures
Unit IV	Cooling and Lubricating System: Need for cooling system, types of cooling system, liquid cooled system, thermosyphon system and pressure cooling system. Lubrication system, mist lubrication, wet sump and dry sump lubrication. Properties of lubricants and coolants. Elements of properties of relevant materials, friction, viscosity of lubricants.	6 lectures
Unit V	Automotive Electronics: Current trends in modern automobiles, Vehicle motion control, Crank angle position sensors-Fuel metering/vehicle speed sensor and detonation sensor-Altitude sensor, flow sensor. Throttle position sensors. Introduction of Electronic fuel Injection and Ignition Systems and Digital Engine Control System.	6 lectures

Recommended Books:

1. Automotive Mechanics, Crouse and Anglin, 10th Ed., Special Indian Edition, Tat McGrawHill, 2004.
2. Fundamentals of vehicle dynamics, Thomas D. Gillespie, Society of Automotive Engineers, 1992
3. Automobile engineering (Vol. - I & II) – Kirpal Singh, Standard Publishers, 2000.
4. Automotive Mechanics, Joseph Heitner, 2nd Ed., CBS Publisher, 2004.

Trade Practice – I : ME 2164 Automobile Servicing Practice – I : 2 Credits (0-0-4)

- General servicing :
 - a) Identification of parts of chassis
 - b) Operation of hydraulic and mechanical jacks
 - c) Use of grease gun, oil splash gun, hydraulic hoist, oil bath, air cleaner
 - d) Adjusting of fan-belt Servicing an oil bath air cleaner
- Wheels and Tyres :
 - a) Removal and assembly of wheels and tyres
 - b) Repairing of tyre puncture
- Front axle and suspension system :
 - a) Adjusting front wheel bearing
 - b) Servicing of leaf spring
 - c) Study of shock absorber
- Steering and front wheel alignment :
 - a) Inspecting steering linkage and adjustment for correct play
 - b) Inspecting and servicing of a steering gear box.
- c) Aligning the steering wheel w.r.t front wheel
 - d) Alignment of front wheels
- Brake :
 - a) Adjusting of brake pedal play and handbrake
 - b) Bleeding of hydraulic brake.
 - c) Overhauling wheel cylinder & master cylinder.
 - d) Adjustment of air brakes.
 - e) Troubleshooting of the braking system.
- Clutch :
 - a) Adjustment of clutch pedal play.
 - b) Removing and refitting of a clutch assembly
 - c) Relining a clutch plate
 - d) Testing the clutch springs
- Gearbox :
 - a) Removing the gearbox from a vehicle
 - b) Stripping a gearbox
 - c) Cleaning and assembly of gear shaft mechanism

Trade Practice – II ME 2165 Automobile Servicing Practice – II : 3 Credits (0-0-6)

- i) Joint :
 - a) Removing a propeller shaft.
 - b) Inspecting and refitting of a propeller shaft
- ii) Rear axle :
 - a) Adjusting gear wheel bearings
 - b) Servicing rear axle assembly.
 - c) Checking tooth contact and adjusting backlash.
 - d) Testing for noise and troubleshooting in power transmission
 - e) Servicing a transfer case
- iii) Engine :
 - a) Removing an engine from a vehicle
 - b) Stripping an engine
 - c) Removing cylinder head and decarburizing
 - d) Cutting valve seats
 - e) Adjusting tappets
 - f) Removing piston and connecting rod
 - g) Cutting ridges in cylinders
 - h) Refitting the piston rings
 - i) Correcting connecting rod bends
 - j) Assembling of piston and connecting rod in cylinder bore
- iv) Cooling system :
 - a) Cleaning the radiator
 - b) Stripping and cleaning the water pump
- v) Lubrication System :
 - a) Overhauling oil pump
 - b) Servicing oil fitters
- vi) Fuel System :
 - a) Cleaning oil tank
 - b) Overhauling fuel pump
 - c) Servicing carburetor
 - d) Adjusting idle speed
- vii) Testing :
 - a) Checking engine compression
 - b) Checking vacuum
 - c) Setting ignition timing
- viii) Basic Electrical System :
 - a) Servicing a battery
 - b) Studying electrical circuits and soldering
 - c) Cleaning and testing spark plug
 - d) Testing a condenser
 - e) Overhauling a distributor
 - f) Servicing a dynamo
 - g) Servicing a starter motor

Trade Theory III : ME 2214 Automobile Servicing – III : 3 Credits (3-0-0)

Unit I	Batteries: Principles and construction of lead-acid battery. Characteristics of battery, rating capacity and efficiency of batteries. Various tests on battery condition, charging methods. Charging System: Generation of direct current. Cut-out. Voltage & current regulators. Compensated voltage regulator alternators principle & constructional aspects and bridge benefits.	8 lectures
Unit II	Starting System: Principle & construction of starter motor. Working of different starter drive units, care and maintenance of starter motor. Starter Switches. Ignition Systems: Types, Construction & working of battery coil and magneto ignition systems. Types and construction of spark plugs; electronic ignition Lighting System & Accessories: Insulated & earth return systems. Positive & negative earth systems. Details of head light & side light, Headlight dazzling & preventive methods. Electrical fuel-pump, Speedometer, Fuel, oil & temperature gauges.	10 lectures
Unit III	Service station equipment–air compressor, car hoists, car washer, spark plug tester. Battery charger, tyre expander and vulcanization, injector tester, Grease guns, hydraulic jacks, wheel alignment gaskets. Workshop calculations and related measurements.	8 lectures
Unit IV	Air Pollution Control: Introduction, air pollution from SI and CI engine exhaust. Air pollution control techniques, Test Procedure & Instrumentation for Emission Measurement and Emission Standards, Emission standards.	8 lectures
Unit V	Motor Vehicle Act: Schedules and sections, Registration of motor vehicles, Licensing of drivers, Control of permit, Limits of speed, traffic signs. Constructional regulations.	8 lectures

Recommended Books:

1. Automobile engineering - R.B.Gupta, Khanna Publishers, 2009.
2. Automobile engineering (Vol. 1) - Kirpal Singh, Standard Publishers , 1996.
3. Problem in automobile mechanism - N.K.Giri, CBS Publishers, 1997.
4. Mechanical estimation and costing - TTTI, Madras, New Age International, 1992.
5. Automobile engineering - G.B.S.Narang, DhanpatRai & Sons, 2004.
6. Automobile Automotive Electrical & electronics system -Derato, 1990.
7. Automotive electrical equipment – Kholi, TMH, 2008.

Trade Practice III ME 2264 Automobile Servicing Practice –III : 2 Credits (0-0-4)

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| i) <u>Engine practice (Petrol):</u>
a) Servicing valve mechanism
b) Checking cylinder bore
c) Checking and adjusting valve timing
d) Trouble shooting in the cooling system
e) Trouble shooting in the lubrication system
f) Trouble shooting in the fuel system
g) Trouble shooting in the ignition system
ii) <u>Engine Practice (Diesel):</u>
a) Starting, stopping and general maintenance of diesel engine
b) Reconditioning valves & adjusting valve tappets
c) Adjusting slow speed | iii) <u>Fuel system (Diesel):</u>
a) Bleeding fuel line for air locks
b) Fixing and brazing nipples for high pressure pipelines
c) Cleaning of air filter
d) Cleaning of oil filter
e) Cleaning of fuel filter
f) Servicing a fuel feed pump
g) Stripping an injection pump
h) Setting injection timing on engine
i) Testing injection on test bench
j) Testing injector on test bench
k) Testing of pneumatic governors |
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Trade Practice IV ME 2265 Automobile Servicing Practice –IV : 2 Credits (0-0-4)

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| i) <u>Electrical System:</u>
a) Servicing a battery charger
b) Finding a polarity of battery terminal
c) Testing, repairing and adjusting regulators
d) Aligning head lights
e) Servicing electric horn
f) Servicing a wind screen wipers
g) Repairs of traffic signal indicators noise
g) Servicing alternators
i) Writing a technical report or auxiliary
j) Trouble shooting in electrical circuit report about an | ii) <u>Driving Practice & Miscellaneous:</u>
a) Forward and reverse driving
b) Driving on wet surface, drive from a slope
c) Parking a car
d) Maintenance of shop-floor equipments
e) Diagnosis of noise from engine
f) Locating and rectifying under carriage
g) Servicing the silencer
h) Preparation of an estimate for repairs in a equipments car
i) Writing a technical report about an industrial visit. |
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Trade : MECHANICAL CRAFTSMANSHIP**Trade Theory – I : ME 2117 Machine Tools and Operations : 3 Credits (3-0-0)**

Unit I	Introduction to Machine tools, classifications, work-tool motions of common machine tools. Lathe: working principle, classifications, specifications, various parts, and its mechanism; Lathe operations: plain turning, taper turning, thread cutting, knurling; Work holding devices, accessories and attachments. Process parameters and its important: cutting speed, feed and depth of cut, machining time evaluation, Taper turning and thread cutting calculation. Defects & remedies in lathe operations.	8 lectures
Unit II	Drilling machine: working principle, classifications, specifications, various parts & its mechanism of common drilling m/cs. Drilling machine operations. Tap -drill size. Gang and multi spindle drilling. Process parameters and drilling time calculation.	8 lectures
Unit III	Shaping machine: working principle, classifications, specifications, shaper mechanisms: reciprocating, quick return, stroke length adjustment, & feed mechanism; shaper operations: plain, angular, dovetail, t-slot, key-way cutting, contour, estimation of cutting speed & machining time, hydraulic shaper: its principle & advantages, shaper vs planner, slotter.	10 lectures
Unit IV	Milling machine: working principle, classifications & specifications Construction of Column & knee type milling machine, Vertical milling machine, etc. Milling operations: plain, angular, face, straddle, gang, key way cutting & spur gear cutting. Milling cutters. Cutting speed, feed, and machining time evaluation.	8 lectures
Unit V	Introduction to grinding machines: classifications & its constructions; different grinding operations. Use of Cutting fluids: types, applications & its selection. Qualities of good cutting fluids. Measuring instruments (construction, types, and applications): Vernier calliper, micrometre, and dial gauge. Errors in measurements and remedies.	8 lectures

Recommended Books :

1. Elements of workshop technology (Vol. - I) - S.K.HazraChoudhury, Media Promoters, 2008
2. Workshop Technology (Vol II), Raghuvangshi, Dhanpat Rai, 2016
3. Production technology (manufacturing processes) - P. C. Sharma, S. Chand, 7th Ed, 2006
4. Production technology - R.K.Jain, Khanna Publishers, 17th Edition, 2014.
5. Manufacturing and machine tool operation - Herman. W.Pollak, Prentice Hall Inc. Second Edition, Mar 1979.

Trade Theory – II : ME 2118 Sheet Metal, Carpentry & Welding : 3 Credits (3 – 0 – 0)

Unit I	Sheet metal applications in Industry; Hand tools used, Sheet thickness measurement, Materials for sheet metal jobs; Basic sheet metal operations; sheet metal development of different objects and its production: Boxes, funnel, charcoal pot, gaskets, choola, bucket, and shelves. Estimation of material requirement. Area and volume calculations. Finishing of sheet metal articles: painting and galvanizing.	12 lectures
Unit II	Types of woods and its uses, seasoning of woods; various wood working machines and their applications: wood working lathe, band saw, circular saw and mortising machine. Wood working operations; Introduction to pattern making; pattern allowances; different types of pattern; estimation of wood requirements for furniture making; Wood crafting	12 lectures
Unit III	Welding; Classification/different types of welding; Compatible materials for welding joints; Arc and gas welding equipments & safety measures, different welding joints and their uses; welding techniques; Introduction to thermit welding, forge welding, spot welding, MIG and TIG welding.	10 lectures
Unit IV	Different types of electrodes and their specifications; flux, flux materials & properties of fluxes; Welding symbols; Welding defects, Testing of welds. Weld inspection; Introduction to soldering and brazing;	8 lectures

Recommended Books:

1. Carpentry: A complete guide, HS Bawa, 1987, New Delhi : Tata McGraw-Hill.
2. Elements Of Workshop Technology Vol-1 by SK Hajra Choudhary, 2008, Media Promoters Pub
3. A course in workshop technology, Raghuvanshi, 2015, Dhanpat Rai & sons
4. Welding and welding technology, Little, TMH, 2001
5. Principles of Welding Technology, LM Gourd, 1995, 3rd edition, A Butterworth-Heinemann Pub

ME 2167 Trade practice-I: Craftsmanship Practice – I : 2 Credits (0 – 0 – 4)

Welding (4 hrs): Equipments and safety precautions. Setting of various welding equipments, Practice on welding joints: Joints preparation, joint making (lap, butt, single V, double V, Tee, Corner joint), gas welding and cutting practice. Demonstration of advanced welding processes.

Crafting by welding: Fabrication of items by welding such as Railing, Gates, Pot holders, racks etc

Recommended Books:

1. Elements of Workshop Technology Vol-1 by Choudhury H S K, Media Promoters, 2008.
2. Elements of Workshop Technology Vol 2 Machine Tools by Choudhury S K, Media Promoters, 2010.
3. Workshop Technology, Vol. I by W. A. J. Chapman, CBS, 5 edition, 2001.
4. Workshop Technology, Vol. II by W. A. J. Chapman, CBS, 4 edition, 2007.
5. Workshop Technology, Vol. III by W.A.J. Chapman, CBS, 3 edition, 1995.

ME 2168 Trade Practice II : Craftsmanship Practice – II : 3 Credits (0 – 0 – 6)

Machine Shop (4 hrs): Lathe practice on plain turning, step turning, taper turning, knurling, drilling, boring, counter shank inking, etc.,

Practice on Shaping m/c: square cutting (plain and angular), cutting tool grinding, Practice on drilling. Simple jobs in machine tools.

Demonstration on surface grinding machine,

Demonstration and simple practice on milling machine,

Carpentry (2 hrs): Exposure to various wood working machines, wood working operations, etc., Practice of making house hold items, decorative articles, etc.

Recommended Books:

1. Elements of Workshop Technology Vol-1 by Choudhury H S K, Media Promoters, 2008.
2. Elements of Workshop Technology Vol 2 Machine Tools by Choudhury S K, Media Promoters, 2010.
3. Workshop Technology, Vol. I by W. A. J. Chapman, CBS, 5 edition, 2001.
4. Workshop Technology, Vol. II by W. A. J. Chapman, CBS, 4 edition, 2007.
5. Workshop Technology, Vol. III by W.A.J. Chapman, CBS, 3 edition, 1995.

ME 2217 Trade Theory –III : Foundry, Forging and forming : 3 Credits (3 – 0 – 0)

Unit I	Introduction to foundry tools and equipments, pattern making, pattern materials and allowances, types of patterns, segmentation in pattern making. Moulding and core making processes, moulding materials and their properties.	8 lectures
Unit II	Gating and risering, Melting and pouring techniques, fettling of casting, inspection and heat treatment of castings and casting defects	8 lectures
Unit III	Introduction to forging tools and equipments, safety in forging, forging operations, recrystallisation, slip and twinning,	8 lectures
Unit IV	Machines used in forging, equipments used, hammer forging, drop forging, press forging, liquid forging, forging die design and forging defects.	8 lectures
Unit V	Introduction in metal forming, plastic deformation, types of forming (hot, warm and cold), Rolling and extrusion processes, Advantages, disadvantages and limitations and applications.	10 lectures

Recommended Books:

1. Manufacturing Technology (Foundry, Forming and Welding), P.N.Rao, second edition, Tata Mcgraw Hill publishing House, 2007.
2. Elements of Workshop Technology (Vol I & II), S. K. HajraChoudhary, AK HajraChoudhary and N. Roy, Media Promoters & Publishers Pvt. Ltd., 2007.
3. Elements of Manufacturing Processes, B.S.NagendraPrashar and R.K.Mittal, Eastern Economy Edition, 2007.
4. Fundamentals of Manufacturing Processes, G.K.Lal and S.K.Choudhury, Narosa publishing House, 2010.

ME 2267 Trade Practice III : Craftmanship Practice – III : 2 Credits (0 – 0 – 4)

Machine shop –II (4 hrs): Practice on thread cutting: Metric (V- thread) and square thread.

Nut & Bolt assembly, Practice on milling m/c: index head and its functions, Spur gear cutting, etc., Practice on Shaping m/c: T-slot, dove – tail groove etc.,

Demonstration on accessories/attachment: lathe, milling m/c, shaping machine, etc.

ME 2268: Trade Practice-IV : 2 Credits (0-0-4)

Forge Shop: Introduction to hand tools, tongs, anvil, swage block, forge hearth, smithy operations, forging operations and making of simple jobs like chisel, rings, bolt head, chain link.	28 hours
Foundry Shop: Introduction foundry hand tools, sand casting, melting of non-ferrous alloys, making small castings.	28 hours

Recommended Books:

1. Manufacturing Technology (Foundry, Forming and Welding), P.N.Rao, second edition, Tata Mcgraw Hill publishing House, 2007.
2. Elements of Workshop Technology (Vol I & II), S. K. HajraChoudhary, AK HajraChoudhary and N. Roy, Media Promoters & Publishers Pvt. Ltd., 2007.

Syllabi of courses offered to other branches only**ME 2121 Workshop Theory &Practice : 4 Credits (2- 0-4) (For AE[TM] students)**

Unit I	Introduction to safety measures in workshops, principles of working in workshops, constructional features of machine tools like lathe, drilling machine, shaping machine, milling machine and grinding machine, their operational features, types of cutting tools, selection of cutting speed and feed,	12 lectures
Unit II	Materials, their classification, general properties, system of designation of Iron and Steel, IS codes, specification of structural/heat treatable steels, standard sizes of hot rolled products, symbolic designation of essential properties of materials, color codes, properties of copper and its alloys, aluminum and its alloys, zinc alloys, other non metal materials, ASME, BIS codes for size and shape of materials	8 lectures
Unit III	Engineering components, limits and fits, terminology of ISO system, bolts, nuts and other fasteners, IS codes for fasteners, threads, measurement of thread profile, pitch, standard bolts, nuts, washers, rivets, pins, key selection, self holding tapers, metrological instruments used in shop floors, sine bar, thread gauge & surface plates.	8 lectures
Machine shop practice	Principal parts of tool, tool geometry, demonstration on lathe, its various parts & functions, job & tool holding procedure, operational aspects, simple jobs involving plain turning, step turning, taper turning and facing, practice in shaping machine, drilling machine, milling machine and grinding machine, calculation of cutting speed, material removal rate and machining time.	28 hours
Smithy shop practice	Introduction to fitting and safety aspect, use of different tools (functions, types and specifications), practice simple fitting jobs, different tools & their uses, standard material available for smithy works, manufacturing chisel and hexagonal bolt, chain link manufacturing, practice in forging operation, drawing, upsetting & swaging punching.	28 hours

Recommended Books:

1. Elements of Workshop Technology, Vol I & II, S. Kumar, H. Choudhury and S.K. Bose, Bombay: Media Promoters & Publishers PVT Ltd., 3rd Ed., 1978.
2. Shop Theory, J. Anderson & E. Tatro, Tata McGraw-Hill, 6th Ed., 1990.
3. Manufacturing Technology: Foundry, Forming and Welding, P.N. Rao, Tata McGraw Hill, 3rd Ed., 2014.
4. Principles of Manufacturing Materials and Processes, J.S. Campbell, Tata McGraw Hill, 1961.

ES 2201 Technical Mechanics : (For AE, CE, EC & EE students) 4 Credits (3-1-0)

Unit I	Inertial and Non inertial frames of reference; Free Body Diagram; Internal and External forces; Force systems; Concept of moment, equilibrium principles; Equilibrium of concurrent and coplanar force systems; equilibrium of bodies in space, Laws of Mechanics. Tutorials	8 lectures
Unit II	Types of structures, Supports and support reactions: Method of Joints, Method of Sections. Tutorials.	6 lectures
Unit III	Static Analysis of systems with friction: Friction and impending motion, rolling resistance, Wedge friction. Tutorials	6 lectures
Unit IV	Centroid, centre of mass, centre of gravity, concept of first moment, centroid of a length, centroid of an area, Theorem of Pappus and Guldinus, centroid of a volume etc., Moment of Inertia: parallel axis theorem and perpendicular axis theorem. Tutorials	7 lectures
Unit V	Kinematics of Rigid Body: Types of motion, fixed axis rotation, planar motion of a rigid body, instantaneous centre of rotation, relative velocity and acceleration for points on a rigid body. Tutorials	7 lectures
Unit VI	Dynamics of a Rigid Body: D'Alembert's principle, translation of a rigid body, rotation of a rigid body about a fixed principal axis, plane motion of a rigid body, general motion of a rigid body. Projectiles and SHM; Impact of elastic bodies: Co-efficient of restitution. Tutorials	8 lectures

Recommended Books:

1. Engineering Mechanics: Statics and dynamics, H. Shames, 4th Ed, PHI, 2002.
2. Vector Mechanics for Engineers, Vol I - Statics, Vol II - Dynamics, F. P. Beer and E. R. Johnston, 9th Ed, Tata McGraw Hill, 2011.
3. Engineering Mechanics, Vol I - Statics, Vol II - Dynamics, J. L. Meriam and L. G. Kraige, 6th Ed, John Wiley, 2008.
4. Engineering Mechanics: Principles of Statics and Dynamics, R. C. Hibbler, Pearson Press, 2006.
5. Introduction to Statics and Dynamics, Andy Ruina and Rudra Pratap, Oxford University Press, 2011.
6. A Textbook of Engineering Mechanics, Dr. R.K. Bansal, Sanjay Bansal, Laxmi Publication, 2015.

Department of Chemistry

CY 1101 Chemistry I : 4 Credits (3- 0- 2)

Unit I	Unit I	Structure of Atom : Bohr's model of hydrogen and hydrogen like atoms, atomic spectrum of hydrogen, energy of electron, de-Broglie's equation and uncertainty principle; concept of atomic orbitals (s, p and d-orbitals) and their shapes etc. ; quantum numbers, Pauli's exclusion principle, Hund's rule and Aufbau principle. Electronic configuration of elements.	6 lectures
Unit II	Unit II	Modern periodic table and periodic properties : Modern periodic law, main features of long form of periodic table, periodic properties: atomic and ionic radii, metallic character, ionization potential, electron affinity and electronegativity. General feature and characteristics of s, p, d and f-block elements.	6 lectures
Unit III	Unit III	Chemical Bonding : Ionic and covalent bonds. Salient features of valence bond theory, formation of H ₂ - molecule through atomic overlap and P.E. Diagram, s and p bonds, sp, sp ² and sp ³ hybridizations with reference to CH ₄ , BF ₃ , and BeCl ₂ molecules, VSEPR theory, hybridization and shapes of NH ₃ and H ₂ O Molecules, Hybridization and geometry of PCl ₅ , SF ₆ , C ₂ H ₄ and C ₂ H ₂ molecules, M.O. theory, salient features, M.O. diagram of H ₂ , He ₂ ⁺ , N ₂ and O ₂ and bond order, Hydrogen and metallic bonds.	9 lectures
Unit IV	Unit IV	Hydrocarbons and Haloalkanes : Classification of Organic compounds, IUPAC nomenclature of hydrocarbons and compounds containing functional groups, Isomerism, aromatic hydrocarbons, structure of benzene, preparation and properties of benzene. Preparation and properties of haloalkanes.	9 lectures
Unit V	Unit V	Compounds with Functional Groups : General methods of preparation and properties: alcohol, phenol, ether, aldehydes, ketones, carboxylic acids, nitro compounds, amine and azo compounds.	12 lectures

Recommended Books:

1. Modern's a b c of Chemistry, (Vol-I&II), S.P.Jauhar and S.K. Malhotra, Modern Publishers, New Delhi.
2. Comprehensive Chemistry (for Class XI and Class XII), N.K.Verma & S.K. Khanna, Laxmi Publications(P) Ltd. New Delhi.
3. Pradeep's New Course Chemistry (for Class XI and Class XII), S.C.Kheterpal, P.N.Kapil, S.N.Dhawan and R.S. Nandwani, Pradeep Publications, Jalandhar.
4. Chemistry (for Class XI and Class XII), NCERT, New Delhi.
5. Chemistry (Part I and Part-II), P.R.Mishra, B.Bhushan and H.R Sharma, Arya Book Depot, New Delhi.
6. Principle of Physical Chemistry, B.R. Puri, L.R. Sharma, M.S. Pathania, 2013, Vishal Publishing Co., Jalandhar.
7. Physical Chemistry, P.C. Rakshit, 7th Edn., 2004, Sarat Book House, Calcutta.

CY 1201 Chemistry II : 4 Credits (3- 0- 2)

Unit I	Gaseous state : Physical properties of gases, Boyle's law, Charle's law, Avagadro's law, Dalton's law of partial pressure, Graham's law of diffusion, ideal gas equation, kinetic molecular theory of gases and kinetic equation, deviation from ideal gas behaviour , Van der Waal's equation, critical phenomena, P-V-T relationship of gaseous state, continuity of state, critical constants and their determination, Van der Waal's equation and critical constants, principle of corresponding state, Joule-Thomson effect and liquefaction of gases.	11 lectures
Unit II	Chemical Equilibrium : Reversible reaction, law of mass action, its application to chemical equilibrium and heterogenous equilibrium, Le-chatelier's principle and its application. Ionic equilibria in aqueous solutions, theory of electrolytic dissociation. Ostwald's dilution law, solubility product and common ion effect, their application in qualitative analysis. Concepts of strong acids and bases, acid-base equilibria, pH, buffer solution, hydrolysis of salts.	11 lectures

Unit III	Redox reactions: Oxidation and reduction process, oxidation state, calculation of equivalent weights of oxidising and reducing agents, balancing of redox reactions using oxidation number change and ion electron methods.	4 lectures
Unit IV	Electrochemistry-I: Metallic and electrolytic conductance, specific, equivalent and molar conductance, measurement of conductivity. Variation of conductance with dilution, Kohlrausch's law and its application. Faraday's laws of electrolysis, statement, explanation and applications. Electrolysis and applications. Electrolysis of fused NaCl, aqueous NaCl, H ₂ SO ₄ , NaOH and aqueous CuSO ₄ using attackable and unattackable electrodes.	7 lectures
Unit V	Electrochemistry-II: Electrochemical cells (General principle and working), Reversible electrodes and their types, Single electrode potentials, EMF of a cell. Standard Hydrogen Electrode(SHE), standard electrode potential. Electrochemical series and its applications, Nernst equation for electrode and cell potential. Primary cells: Le Clanche cell, Mercury cell, Secondary cells : Lead acid storage cell, Ni-Cd cell, Ni-Fe cell; Fuel cells: H ₂ -O ₂ cell.	9 lectures

Recommended Books:

1. Modern's a b c of Chemistry, (Vol-I&II), S.P.Jauhar and S.K. Malhotra, Modern Publishers, New Delhi.
2. Comprehensive Chemistry (for Class XI and Class XII), N.K.Verma & S.K. Khanna, Laxmi Publications(P) Ltd. New Delhi.
3. Pradeep's New Course Chemistry (for Class XI and Class XII), S.C.Kheterpal, P.N.Kapil, S. N.Dhawan and R.S. Nandwani, Pradeep Publications, Jalandhar.
4. Chemistry (for Class XI and Class XII), NCERT, New Delhi.
5. Chemistry (Part I and Part-II), P.R.Mishra, B.Bhushan and H.R Sharma, Arya Book Depot, New Delhi.
6. Principle of Physical Chemistry, B.R. Puri, L.R. Sharma, M.S. Pathania, 2013, Vishal Publishing Co., Jalandhar.
7. Physical Chemistry, P.C. Rakshit, 7th Edn., 2004, Sarat Book House, Calcutta.

Department of Mathematics

MA-1101 MATHEMATICS-I : 4 Credits (3-1-0)

Unit I	Trigonometric ratios of compound, multiple and sub-multiple angles, general solution of trigonometric equations, properties and solution of triangles, inverse circular functions	8 Lectures
Unit II	Complex numbers, modulus and amplitude of complex numbers, cube roots of unity and their properties, De-Moivre's theorem.	8 Lectures
Unit III	Logarithms and its properties, partial fractions, arithmetic progression (A.P) and geometric progression (G.P), permutation and combination	8 Lectures
Unit IV	Binomial theorem for positive integral index, general and middle terms, greatest term, Binomial theorem for any index, mathematical induction	8 Lectures
Unit V	Real functions, limit, continuity and differentiability of real functions, algebra of derivatives, differentiation of parametric, exponential, logarithmic, hyperbolic, trigonometric and inverse trigonometric functions	10 Lectures

Recommended Books:

1. Mathematics for Class-XI and Class-XII, R.D Sharma, Dhanpati Rai, New Delhi
2. Plane Trigonometry, Part-I, S.L.Loney, S. Chand & Co. New Delhi, 1998.

References:

1. A text book of Higher Algebra, Hall & Knight, S.Chand & Co. New Delhi, 1998.
2. Elementary Engineering Mathematics, B.S. Grewal, Khanna Publishers, 1999.

MA-1201 MATHEMATICS-II : 4 Credits (3-1-0)

Unit I	Introduction to two dimensional co-ordinate geometry , distance formula, section formula, equation of a straight line, distance of a point from a line, angle between two lines, angle bisector between two lines, pair of straight lines.	8 Lectures
Unit II	Circle, tangent and normal to a circle introduction to conic section, parabola, ellipse and hyperbola.	6 Lectures
Unit III	Introduction to indefinite integration, integration by substitution, integration by parts, integration of rational functions, definite integral, properties of definite integral, area of simple curves using definite integrals.	8 Lectures
Unit IV	Successive differentiation, Leibnitz's theorem, Roll's theorem and Lagrange's Mean value theorem, L' Hospital rule, maxima and minima of a function of single variable, curve tracing, curvature.	11 Lectures
Unit V	Introduction to three dimensional co-ordinate geometry, direction cosines, equation of a plane, angle between two planes.	9 Lectures

Recommended Books:

1. Elements of Co-ordinate Geometry, S.L. Loney, S Chand & Co. New Delhi, 2000.
2. Differential Calculus, Shanti Narayan
3. Mathematics for Class-XI and Class-XII, R.D Sharma, Dhanpati Rai, New Delhi

References:

1. Engineering Mathematics, N.P. Bali, Laxmi Publication.

MA-2101 MATHEMATICS-III : 4 Credits (3-1-0)

Unit I	Angle between a plane and a line, general and symmetrical form of a straight line. coplanarity, shortest distance of lines. sphere and its equations.	8 Lectures
Unit II	Determinant of matrices of order two and three, minors and co-factors, Crammer's rule, matrix, types of matrices, operation on matrices, invertible matrices, rank of a matrix, solution of linear simultaneous equations using inverse of matrices.	8 Lectures
Unit III	Vector algebra: dot and cross products, scalar triple product and vector triple product, and its applications	6 Lectures
Unit IV	Basic concepts of differential Equations, formation of differential equations, solution of differential equation of first order first degree, general and particular solution of differential equation	8 Lectures
Unit V	Measure of dispersion, range, quartile deviation, mean deviation, variance, coefficient of variation. moments, skewness and kurtosis, probability and its basic properties, conditional probability, independent events, Baye's theorem.	12 Lectures

Recommended Books:

1. Differential Equations, M.D. Raisinghania, S. Chand.
2. A Text Book of Engineering Mathematics, N.P. Bali & M. Goyal, Laxmi Publications.
3. Mathematics for class XI and XII, R.D. Sharma.

References:

1. Calculus and Analytic Geometry, G.B. Thomas and R.L. Finney, Addison Wesley, 9th edition, 1996.
2. The Manga Guide to Statistics, S. Takahashi, No Starch Press, 2008.
3. Schaum's Outline of Vector Analysis, R. Spiegel, Schaum's Outline Series.

Department of Physics

PH 1101 Physics I : 5 Credits (4-0-2)

Unit I	Units for measurements, system of units, fundamental and derived units, dimensions and their applications, orders of magnitude, accuracy and errors in measurements, random and instrumental errors, significant figures and rounding off, theory of measurements- idea of least counterexamples of vernier calipers, screw gauge, traveling microscope, spherometer, measurement of mass and weight, use of graphs in experimental physics. Vectors and scalars, vectors in two and three dimensions, unit vectors, vector addition and multiplication, resolution of a vector in a plane, rectangular components, scalar and vector products. Motion in two dimensions, projectile motion, uniform circular motion, concept of angular velocity and acceleration, torque, conservation of linear momentum, rocket propulsion, static and kinetic friction, laws of friction, rolling friction, lubrication. Parallelogram law and its verification	12 Lectures
Unit II	Elastic collision in one and two dimensions, gravitational potential energy and its conversion to KE, spring constant, potential energy of spring, different forms of energy, conservation of energy, renewable energy sources. Variation of acceleration due to gravity of earth with latitude and altitude, gravitational PE near the surface of the earth, gravitational potential, orbital velocity, escape velocity, geostationary satellite.	10 Lectures
Unit III	Interatomic and intermolecular forces, states of matter. elastic properties, Hooke's law, Young's modulus and its experimental determination (Searle's experiment), Bulk modulus, Shear modulus, Poisson's ratio. Fluid pressure, Pascal's law, buoyancy, floatation, Archimedes principle and its experimental verification, atmospheric pressure, surface energy and surface tension, angle of contact, examples of drops and bubbles, capillary rise and determination of surface tension using capillary rise method, detergent and surface tension, viscosity.	10 Lectures
Unit IV	Terminal velocity, Poissuille's formula (derivation using dimensional analysis only, Stoke's law, experimental determination of coefficient of viscosity, streamline flow, Reynold's number, Bernoulli's theorem and its application.	6 Lectures
Unit V	Kinetic theory of gases, pressure exerted by a gas, KE and temperature, absolute temperature scale. Heat and temperature, zeroth law of thermodynamics, conversion from one scale to other, transfer of heat: conduction, convection and radiation, Newton's law of cooling and experimental verification.	8 Lectures
Unit VI	Periodic motion, simple harmonic motion and its equation, oscillations due to spring, KE and PE in SHM, experimental determination of 'g' using spring, simple pendulum, derivation of its expression of time period, determination of 'g' using simple pendulum, physical concepts of free, damped and forced oscillations, resonance, determination of velocity of sound using resonance column apparatus.	10 Lectures

Recommended Books:

1. Physics for Class XI, Vol. I. Part I & II, NCERT, New Delhi.
2. Physics for Class XI, N.K. Bajaj, Tata McGraw Hill, New Delhi.
3. Physics, R. Resnick, D. Halliday and K.S. Krane, John Wiley & Sons, NY.
4. Modern's ABC, Vol. I, S.K Gupta, Modern Publishers, New Delhi.

PH 1201 Physics II : 5 Credits (4-0-2)

Unit I	Frictional electricity, charges and their conservation, Coulomb's law, concept of electric flux, electric field and potential due to a point charge, dipole, its field along axis and perpendicular to it, concept of dielectric and dielectric constant, conductors and insulators, electrostatic induction, concept of torque, force and torque experienced by a dipole in uniform electric field, presence of free and bound charges inside a conductor. capacitance, parallel plate capacitor with air/ dielectric medium between the plates, series and parallel combinations of capacitors, energy of capacitors, phenomena of lightning.	12 Lectures
Unit II	Electric current, Ohm's law, resistivity, resistance of different materials, temperature dependence of resistance, resistances in series and parallel-verification of Ohm's law, Kirchhoff's laws: illustrations by simple applications, Wheatstone bridge, principle of potentiometer- its application for comparing emf of two cells and determination of internal resistance of a cell. Ammeter, voltmeter, post office box, tangent galvanometer, meter bridge, potentiometer.	12 Lectures
Unit III	Electric power, heating effects of current, Joule's law, thermoelectricity- Seebeck, Peltier and Thompson effects and their explanations, thermocouple. Oersted's experiment, Biot-Savart law (statement only), magnetic field due to a straight wire and circular loop, force on a moving charge in a uniform magnetic field, force on a current carrying conductor and torque on current loop in a magnetic field, forces between two parallel current carrying conductors, definition of ampere, moving coil galvanometer and its conversion into ammeter and voltmeter.	12 Lectures
Unit IV	Natural and man made magnets, properties of bar magnet, current loop as magnetic dipole, magnetic moment, torque on a magnetic dipole in a uniform magnetic field. Lines of force in a magnetic field, comparison of bar magnet and solenoid, earth's magnetic field and its source (elementary ideas), electromagnets, permanent magnets. Induced emf, Faraday's law, electromagnetic induction, self and mutual inductance, alternating currents and ac generators.	8 Lectures
Unit V	Refraction and dispersion of light due to prism, determination of minimum deviation, angle of prism, optical instruments: simple and compound microscopes, refracting (astronomical) and reflecting (Newtonian) telescopes, resolving power and magnifying power. Vision defects and its rectification.	6 Lectures
Unit VI	Wave motion, speed of a wave, principle of superposition, reflection of waves, harmonic waves (qualitative treatment only), formation of standing waves (graphical treatment only), standing waves in strings and pipes, beats, Doppler effect, determination of velocity of sound using sonometer.	6 Lectures

Recommended Books:

1. Physics for Class XII, Vol. II. Part I & II, NCERT, New Delhi.
2. Physics for Class XII, N.K. Bajaj, Tata McGraw Hill, New Delhi.
3. Physics, R. Resnick, D. Halliday and K.S. Krane, John Wiley & Sons, NY.
4. Modern's ABC, Vol. II, S.K Gupta, Modern Publishers, New Delhi.

Department of Humanities and Social Sciences

HS 1101 English – I : Credits 3 (2-0-2)

Unit – I	Origin and Uses of Language, Vocabulary and Pronunciation	5 lectures
Unit – II	Language, Grammar and Usage; Punctuation and Sentence Construction	5 lectures
Unit – III	Story – I: Reading and Explanation; Essay - I: Reading and Explanation	8 lectures
Unit – IV	Paragraph; Essay Writing; Letter Writing	5 lectures
Unit – V	Essay – II: Reading and Explanation	5 lectures

Recommended books:

1. An Outline of the History of English Language – F.T. Wood, Macmillan India Ltd.
2. New Horizons: An Anthology of English prose and Poetry – OUP, New Delhi
3. A remedial English Grammar for Foreign Students – F. T. Wood, Macmillan India Ltd.
4. English Vocabulary in Use: Advanced – M. McCarthy, Cambridge University Press
5. Writing at Work – Neil James, Allen and Unwin
6. Complete Course in English – R J Dixon
7. A New English Grammar – A Allen & J Cornwall

HS 1201 English – II : Credits 3 (2-0-2)

Unit – I	Grammar: Subject Verb Object Agreement; Use of Prepositions; Punctuation.	5 lectures
Unit – II	Précis; Summary; Paragraph; Essay Writing	5 lectures
Unit – III	Detailed study: Reading and Explanation. Story – I Essay - I	8 lectures
Unit – IV	Analysis: Form and Content of Speeches	5 lectures
Unit – V	Basic Oral Skills; Public Speaking	5 lectures

Recommended books:

1. English Vocabulary in Use: Advanced, McCarthy, Cambridge University Press.
2. English for Engineers, Rie, Cambridge University Press.
3. Effective Technical Communication; a Guide for Scientists and Engineers, Marun K. Mitra, Oxford University Press.
4. Comprehension, Précis, and Paragraph Writing, Lawrence Shaffer, Sarup & Sons, Delhi.
5. Writing your Résumé, Howard Simon, DK Essential Managers.

HS 2201 Entrepreneurship : Credits 3 (3-0-0)

Unit-I	Definition, Importance and relevance of entrepreneurship. Entrepreneurial values and attitudes: Innovativeness, independence, risk-taking and analytical ability. Entrepreneurial motivation: achievement planning, personal efficacy, entrepreneurial goal setting. Characteristics of entrepreneurs. Types of entrepreneurs, Rural entrepreneurs, and women entrepreneurs.	8 Lectures
Unit - II	Launching a Business Venture: Identification of investment opportunities, Project formulation, Project screening, market demand forecasting. Project Analysis; Technical, Financial Environmental and Managerial aspects.	9 Lectures
Unit - III	Project Appraisal; Means of financing and working results estimation, Raw materials use, processing, manufacturing and designing.	8 Lectures
Unit -	Percentage and Ratio, Costs, Revenue, profit and loss, Discounting, interest computation, depreciation, Pay back period, Net Present Value calculation, Cost-benefit analysis, Break-even analysis.	9 Lectures
Unit - V	Environment and society, problems of environmental degradation, Socio-economic environment, Political environment and their impact on generating self-employment schemes, Preservation of environment and improvement in the quality of life in rural economy.	8 Lectures

Recommended Books:

1. Project preparation, Evaluation & Implementation, P. Chandra, Tata McGraw Hill
2. Entrepreneurship Development, B.S. Rathore & J.S. Saini, Wiley Eastern Pvt.
3. Agri-Business and Entrepreneurship, Rajgopal, Indian Books & Periodicals
4. Entrepreneurship: Starting a New Business, Anderson, Allied publishers Ltd.
5. Entrepreneurship Development, S. S. Khanka, Sultan Chand & Sons, New Delhi

