EAST PAKISTAN UNIVERSITY OF ENGINEERING & TECHNOLOGY, DACCA

SYLLABUSES

(B. Sc. Engg., M. Sc. Engg., B. Architecture and Master of Physical Planning Courses).

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UNDERGRADUATE CURRICULA.

(B. Sc, Engg.)

Courses common to all branches

lst Semester.			Periods/week
Math.	101	Calculas & Geometry	3
Math.	103	Calculus & Differential equation	3
Ph.	101	Heat, Light & Sound	3
Ph.	102	do Laboratory	3
Hum.	101	Language (English)	2
Drg.	102	Engineering Drawing	6
C. E.	101	Surveying	1
M. E.	101	Basic Heat Engineering	3
		or	
E. E.	201	Basic Elect. Engg	
M. E.	102	Basic Heat Engg. (Laboratory)	3
		or	
E. E.	102	Basic Elcet. Engg. (Laboratory)	
M. E.	103	Mensuration	1
Sh.	102	Carpentry	3
		or	
Sh.	104	Foundry	
Sh.	106	Sheet metal & welding	3
		or	
Sh.	108	Fitting and Machine	
		Physical Training	
			34

C. E. 102-Survey Practical two weeks in the field.

2nd Semester.			Periods/week.
Math.	201	Calculus & Differential Equation	3
Math.	203	Analytical solid Geometry & Matrices	3
Ph.	201	Light, Heat & Modern Physics	3
Ph.	202	do Laboratory	3
Chem.	201	Chemistry	3
Chem	202	do Laboratory	3
Drg.	202	Engineering Drawing	3
C. E.	201	Surveying	1
E. E.	201	Basic Eiectrical Engg.	3
		or	
M. E.	101	Basic Heat Engg.	
E. E.	202	Basic Elect. Engg. (Laboratory)	3
		or	
M. E.	102	Basic Heat Engg. (Laboratory)	
Sh.	102	Carpentry	3
		or	
Sh.	104	Foundry	
Sh.	106	Sheet metal and welding	3
		or	
Sh.	108	Fitting and Machine	

34

বাংলাদেশ প্রকৌশল বিশ্ববিদ্যালয়
নং .....
তাং .....
ঢাকা

Syllabus

Correction for pages 3,4,9,12,13,15,16,20,21 & 91 (Vide A/C meeting dt.11.6.67.

Recommended that from the next session Math.401 to be taught in the 3rd semester and be named as Math.301 and Math.301 to be taught in the 4th semester and termed as Math. 401.

C. E. 402	Strength of Material Lab.	3
M. E. 309	Theory of Machines	3
Ch. E. 301	Fluid Flow	3
Ch. E. 303	Industrial Stoichiometry I	3
Ch. E. 304	do (Laboratory)	3
	Physical Training	
		31

4th Semester		periods/week
Math.	403 Complex Variables, Vector Analysis	3
Chem.	403 Physical Chem. II	3
Chem.	404 do (Laboratory)	3
Hum.	401 Engg. Economics	2
E. E.	401 Electrical Engg.	3
E. E.	402 do (Laboratory)	3
Ch. E.	401 Heat Transfer	4
Ch. E.	404 Indl. Stoichiometry II (Laboratory)	3
Ch. E.	405 Fluid Flow II	2
Met.E.	407 Physical Metallurgy	2
Met.E.	408 do (Laboratory)	3
		31

E. P. University of Engg. & Tech.

5th Semester		Periods/week
Math. 505	Statics, Statistics & Fourier's Analysis, Integral & Transform Harmonic Analysis	3
Chem. 501	Organic Chem.	4
Chem. 502	do (Laboratory)	3
Chem. 505	Inorganic Chemistry	3
Chem. 506	Inorganic Chem. (Laboratory)	3
Ch. E. 501	Mass Transfer I	4
Ch.E. 502	do (Laboratory)	3
Ch.E. 503	Chem. process Analysis I	3
Ch. E. 505	Chem. Engg. Thermodynamics I	2
Ch.E. 507	Chem, Engg. Kinetics	3
	Physical Training	

(th Semester		Periods/week
Math.	601 Numerical Analysis	2
Math.	602 do (Laboratory)	2
E. E.	601 Applied Electronics	3
E. E.	602 do (Laboratory)	3
Ch.E.	601 Mass Transfer II	4
Ch.E.	602 do (Laboratory)	6
Ch.E.	603 Chem. Process Analysis II	3
Ch.E.	604 do (Laboratory)	3
Ch.E.	605 Chem. Engg. Thermodynamics II	3
Ch.E.	607 Unit processes	3
		32

7th Semester		Pds/week.
Hum.	701 Industrial Law	2
M.E.	707 Industrial Management I	2
Ch.E.	700 Project	6
Ch.E.	701 Process Control & Instruments	3
Ch.E.	702 do (Laboratory)	3
Ch.E.	703 Plant Design I	2
Ch.E.	704 Do (Laboratory)	3
Ch.E.	705 Chem. Engg. Thermodynamics III	3
Ch.E.	708 Unit Processes (Laboratory)	3
Ch.E.	709 Corrosion and Materials of Construction	2
Chem.	701 Nuclear chemistry	2
	Physical Training	
		31

8th Semester		Pds/week
Hum.	801 Accounting	2
M.E.	807 Industrial Management II	2
Ch.E.	800 Project	8
Ch.E.	803 Plant Design II	2
Ch.E.	804 do (Laboratory)	6
Ch.E.	809 Corrosion and Materials of Construction	3
Ch.E.	810 Seminar	2
Ch.E.	811 Technology of petrolieum & Petro-Chemicals	3
Ch.E.	812 do (Laboratory)	3
	or	
Ch.E.	813 Technology of Pulp and paper	3
Ch.E.	814 do (Laboratory)	3
	or	
Ch.E.	815 Technology of Plastics	3
Ch.E.	816 do (Laboratory)	3
	or	
Ch.E.	817 Technology of Food	3
Ch.E.	818 do (Laboratory)	3
	or	
Ch.E.	819 Technology of Fuels & gas	3
Ch.E.	820 do (Laboratory)	3
		31

CIVIL ENGINEERING

3rd Semester		Pds/Wk.
Math 301	Differential Equations	3
Chem 301	Engineering Chemistry	3
Hum 301	Civics	3
E.E. 301	Electrical Technology	3
E.E 302	—Do—(Laboratory)	3
C.E 301	Mechanics of Material	4
C.E 303	Survey	2
C.E 305	Elements of Framed Structure.	3
C.E 306	-Do-(Sessional)	3
C.E 307	Geology	3
C.E 310	C. E. Drafting	3
	Physical Training	

4th Semester		Pds/Wk
Math	401 Complex Variables, & vector Analysis	3
Hum	401 Engineering Economics	2
Hum	403 Sociology	2
C.E	401 Strength of Materials	3
C.E	402 -Do-(Laboratory)	3
C.E	403 Estimating & Costing (sessional)	3
C.E	405 Basic Fluid Mechanics	3
C.E	407 Geodessy & Photogrammetry	3
C.E	408 Geodessy Practical 4 weeks Field work (in Camp)	
C.E	409 Theory of Structures (I)	3
C.E	411 Details of Construction (sessional)	2
C.E	413 Engg. Material	3
C.E	414 -Do-(Laboratory	3
		33

5th Semester		Pds/Wk
Math 501	Statics, Spherical Trigonometry & Astronomy and Statistics.	4
Hum 801	Accounting	2
C.E 501	Plain and Reinforced Concrete	3
C.E 503	Soil Mechanics	1
C.E 504	-Do-(Laboratory)	3
C.E 505	Hydraulics	3
C.E 506	-Do-(Laboratory)	3
C.E 508	Design & Drawing	3
C.E 509	Theory of Structures II	3
C.E 510	-Do-(Sessional)	3
		28

Physical Training

6th Semester			Pds/Wk
Math	601	Numerical Analysis	2
Math	602	-Do-(Practical)	2
Hum	603	Industrial Administration	3
Hum	605	Technical Report Writing	3
C.E	601	R. C· Structures	3
C.E	602	-Do-(Sessional)	3
C.E	603	Soil Mechanics 11	3
C.E	604	-Do-(Laboratory)	3
C.E	605	Hydrology	3
C.E	607	Railway Engineering	3
C.E	609	Theory & Design of Structures (1)	3
C.E	610	-Do-(Sessional)	3
			34

7th Semester			Pds/Wk
C.E	700	Project & Thesis	9
C.E	701	Water Supply Engineering	3
C.E	702	Do (Laboratory)	3
C.E	703	Irrigation	3
C.F	705	Hydraulic Engineering 1	3
C.E	706	Do(Laboratory)	3
C.E	707	Highway Engineering I	3
C.E	709	Theory & Design of Structures 11	3
C.E	710	Do (Sessional)	3
			33

Physical Training

8th Semester	Pds/Wk
C.E 800 Project & Thesis	9
C.E 801 Sewerage Engineering	3
C.E 803 Draimage & Food Control	3
C.E 805 Hydraulic Engineering II	3
C.E 806 Do (Sessional)	3
C.E 807 Highway Engineering· II	3
C.E 808 Do (Laboratory)	3
C.E 809 Theory & Design of Structures III	3
C.E 810 Do (Sessional)	3
	33

DEPARTMENT OF ELECTRICAL ENGINEERING

3rd Semester	pds/wk
Math 301 Differential Equations	3
Hum 401 Engineering Economics	2
C.E 301 Mechanics of Material	4
C.E 402 Strength of Materials (Laboratory)	3
M.E 307 Heat Engineening	3
M·E 308 do Laboratory	3
M.E 309 Theory of Machines	3
E 300 Electrical Drafting	3
E.E 303 Electrica Circuits I	4
E.E 304 do Loboratry	3
Physical Training	
	31

4th Semester	Pds/wk
Math. 403 Complex Vector Analysis	3
Hum. 601 History of Engineering & Technology	2
Hum 801 Accounting	2
M. E. 409 Fluid Engineering	3
M.E. 410 do Laboratory	3
E.E. 400 Electrical W/shop	3
E.E. 403 Electronics I	4
E.E. 404 do Laboratory	3
E.E. 405 Electrical Machines I	3
E.E. 406 do Loboratory	3
	29

5th Semester	Pds/Wk
Mah. 503 Statistics, Fourier Analysis, Intergral and Harmonic Analysis	3
Chem. 507 Chemistry	2
M.E. 707 Industrial Management	2
E.E. 503 Electronic Shop Laboratory	3
E.E, 503 Electrical Circuits II	4
E.E. 504 do Laboratory	3
E.E. 505 Electrical Machines II	3
E.E. 506 do Laboratory	3
E.E. 507 Electrical Measurements	3
E.E. 508 do Laboratory	3
Physical Training	
	29

6th Semester	Pds/wk
M.E. 807 Industrial Management 11	2
E.E. 603 Electronics II	3
E,E. 604 do Laboratory	3
E.E. 605 Electrical Machines 1 1 1	4
E.E. 606 do Laboratory	3
E.E. 607 Control Systems	3
E.E. 608 do Laboratory	3
E.E. 609 Electromagnetic Fields I	3
E.E. 611 Neuclear Engineering	3
E.E. 620 Electrical Design I (Sessional)	2
	29

7th Semester	Pds/Wk
E.E. 700 Project & Thesis	6
E.E. 701 Physical Electronics	3
E.E. 703 Industrial electronics	3
E.E. 704 do-Laboratory	3
E.E. 705 Power Stations	3
E.E. 707 Transmission & Distribution	3
E.E. 709 Electromagnetic Fields 1 1	3
E.E. 710 do-Laboratory	3
or	
E.E. 711 Power Systems 1	3
E.E. 712 do-Practical	3
E.E 714 Electrical Design 11	2
E.E. 716 Seminar	2
Physical Training	
	31

8th Semester.	Pds/Wk.
E. E. 800 Project and Thesis	9
E. E. 801 Semiconductor Electronics	3
E. E. 803 Electronic III	3
E. E. 804 do-(Laboratory)	3
or	
E. E. 805 Switch Gear & Protection	3
E. E. 806 do-Practical	
E. E. 807 Accoustics & Illumination	3
E. E. 808 do-Laboratory	
or	
E. E. 809 Communication Engineering	3
E. E. 810 do-Laboratory	3
	3
E. E. 812 do-Laboratory	3
	30

MECHANICAL ENGINEERING

3rd Semester	Pds/Wk
Math 301 Differential Equations	3
Ph. 601 Modern Physics	3
Chem 301 Engineering Chemistry	3
Hum 401 Engineering Economics	2
Met. E 301 Metallurgy	2
Met. E 302 do Laboratory	2
M.E 301 Thermodynamics I	3
M.E 302 do Laboratory	3
M.E 303 Engineering Mechanics	3
M.E 305 Machine Drawing	3
Sh. 302 Foundry Practices	6
Physical Training	
	32

4th Semester	Pds/WK
Math 403 Complex Vector Analysis	3
Hum 605 Technical Report Writing	2
E.E 401 Electrical Engineering	3
E.E 402 do Laboratory	3
Met. E 401 Manufacturing Metallurgy	2
Met. E 402 do Laboratory	3
M.E 401 Thermodynamics 1 1	3
M. E 402 do Laboratory	3
M. E 403 Mechanics of Machinery 1	3
M. E 40 Fluid Mechanics I	2
M.E 406 do Laboratory	3
M.E 407 Manufacturing Process I	3
	33

5th Semester	Pds/ Wk
Math 505 Statics, Statistics and Fouriers, Analysis integral and Transform Harmonic, Analysis	
C.E 402 Strength of Materials Lab.	3
C.E 511 Theory of Structures	2
M.E 501 Applied Thermodynamics I	3
M.E 502 do Laboratory	3
M.E 503 Mechanics of Machinery II	3
M.E 504 do Laboratory	3
M.E 505 Fluid Mechanics II	2
M.E 506 do Laboratory	3
M.E 507 Manufacturing Process II	3
M.E 508 do Practical	3
M.E 509 Mechanics of Materials	3
Physical Training	
	34

6th Semester.	Pds/Wk
Math 601 Numerical Analysis	2
Math 602 do Practical	2
or	
Ph. 301 Electromagnetic Theory	**2**
E.E 601 Applied Electronics	3
E.E 602 do Laboratory	3
M.E 601 Applied Thermodynamics II	3
M.E 602 do Laboratory	3
E.E 603 Design of Machine Elements	3
M.E 604 do Practical	3
M.E 605 Fluid Mechanics III	2
M.E 606 do Laboratory	3
M.E 607 Inspection & Quality Control	3
M.E 608 do Laboratory	3
	33

7th Semester

			Pds/wk
Hum	701	Industrial Law	2
M. E	700	Project & Thesis	6
M. E	701	Applied Thermodynamics III	3
M. E	702	do Laboratory	3
M. E	703	Engineering Design & Manufacture	3
M. E	704	do Practical	3
M. E	705	Fluid Mechanics IV	3
M. E	706	do Laboratory	3
M. E	707	Industrial Management 1	2
M. E	709	Methods of Tool Engineering	3
M. E	711	Air Conditioning & Refrigeration 1	2
		or	
M. E	713	Theory of Plasticity 1	2
		or	
M. E	715	Automobile Engineering 1	2
		or	
M. E	717	Control Engineering 1	2
		or	
M. E	719	Operations Research 1	2
		or	
M. E	721	Aerodynamics 1	2
		or	
M. E	723	Power Plants 1	2
		Physical Training	-
			33

8th Semester	Pds/Wk.
Hum 801 Accounting	2
M. E 800 Project & Thesis	12
M. E 801 Applied Thermodynamics IV	3
M. E. 802 do Laboratory	3
M. E 805 Fluid Mechanics V	3
M. E 806 do Laboratory	3
M. E 807 Industrial Management II	2
M. E 810 Methods & Tool Engineering Practical	3
M. E 811 Air Conditioning & Refrigeration II	3
or	
M. E 813 Theory of Plasticity II	3
or	
M. E 815 Automobile Engineering II	3
or	
M. E 817 Control Engineering II	3
or	
M. E 819 Operation Research II	3
or	
M. E 821 Aerodynamics II	3
or	
M. E 823 Power plants II	3
	33

Correction for pages 20,21,126 & 134 vide Academic Council meeting dated - 11-6-67.

Recommends that the following courses viz-Met. E. 307 -2 periods/week, Met.E. 305 -2 periods/week and Met.E. 511 -3 periods/week may be made into two courses viz.-Met. E. 511 'Metal Physics' - 3 periods/week and Met.E. 305 (Geology and Mineralogy) -3 periods/week. Recommends the detail syllabii after some readjustment of the old syllabii as mentioned below :

Met. E. 511 Metal Physics. V Met. E.

Atoms and electrons; The structure of the free atom; period table; Metal and non-metal. States of matter-the solid state. Grystals : bending in crystals; the metallic bond in crystals of metals and alloys; electron bond theory. Crystallographic terms : symmetry; space lattice; unit cell; cubic,hexagonal and other common metallic crystal types; miller and Miller-Bravais in dices of planes and directions. Crystallographic projection. Origins of the main thermal,electrical,magnetic,optical and elastic properties of metals and alloys in electronic and crystallographic factors, Structure-sensitive properties : significance of lattice defects;dislocation; duffusion;mechanical properties.

The atomic nucleus,nuclear phenomena and their applications: nuclear fuel,moderators,shielding elements.

Met.E. 305 - Geology and Mineralogy III Met.E.

Physical geology-A general view of earth. Denudation by weather, rivers, glaciers and sea. Transportation, deposition and consolidation of detenitus. Volcances and volcanic products, classification of Rocks-Tje igneous rocks,the metamosphic rocks and their sub-divisions.The geological age. The relation of rock and their ages. Earthquakes, the earth's interior, Mountain and related land forms. Hydrology Surface water, Subsurface water, the fountain water, etc.

Occurrance and association of minerals, Rock-forming minerats,veins and veinminerals. Gem minerals,Ornamental minerals. The refractories,or minerals of Iron, Copper ,Zinc, Tin, Alluminimm, Antimony etc.

5th Semester		Pds/Wk
Hum 801	Accounting	2
Met.E 501	Fuels & Combustion I	3
Met.E 504	Metallurgical Analysis and Assaying practical	6
Met.E 505	Furnance Refractories and slags	3
Met.E 506	do Laboratory	6
Met.E 507	Mineral Dressing	3
Met.E 509	Foundry Engineering	3
Met.E 510	do Practical	3
Met.E 511	Mineralogy	3
	Physical Training	
		32

6th Semester		Pds/Wk
E. E 601	Applied Electronics	3
E. E 602	do Laboratory	3
Met.E 601	Fuels & Combusion I I	3
Met.E 602	do Laboratory	3
Met.E 603	Ferrous Metallurgy I	3
Met.E 605	Non-Ferrous Met. I	3
Met.E 607	Metallurgical Calculations	3
Met.E 608	do Practical	6
Met.E 610	Foundry Engineering Practical II	3
Met.E 611	Physical Metallurgy I	3
		33

7th Semester		Pds/Wk
Hum 701	Industrial Law	2
M. E 707	Industrial managemet 1	2
Met.E 700	Project and Thesis	6
Met.E 701	Metal Technology 1	3
Met.E 703	Ferrous Metallurgy 11	3
Met.E 705	Non-Ferrous Met. 11	3
Met.E 708	Mettallurgical Analysis and assaying practical	6
Met.E 710	Metallography & Heat Treatment I practical	3
Met.E 711	Physical Metallurgy 11	3
	Physical Training	
		31

8th Semester		pds/wk
M. E 807	Industrial Management 11	2
Met. E 800	Project and Thesis	9
Met. E 801	Metal Technology 11	3
Met. E 803	Ferrous Metallurgy 111	3
Met. E 805	Non-Ferrous Met. 111	3
Met. E 810	Metallography & Heat Treatment Practical 11	6
Met. E 812	Seminar	4
		30

Wk

2
2
6
3
3
3

6
3

3

31

pds/wk

2
9
3
3
3

6
4

30

Chemistry

Detailed Syllabus of Chemistry.

Chem. 201 (3) Common

The fundamentals of Chemical reactions, matter and energy, the Organization of fundamental particles in atoms, atomic nucleus, the atomic number, isotopes, isobars, the Avogadro number, Bohr hydrogen atom, wave nature of electron, wave mechanics, the four quantum numbers of electrons, their significance. Directional characteristics of orbitals, Pauli exclusion principle, ionization potential and ion formation, electron affinity. The history of discovery of the inert gases, their proparties and uses, role of the inert gases in the elucidation of Chemical bonding. Valence and chemical bonding. Electro-valence, covelence, co-ordinate valence, Hydrogen bond and metal bond, Polar and non-polar bond.

Short history of the development of periodic table discussion of Mendeleev's periodic table and long table. Usefulness of the periodic table.

1. **Thermochemistry**:-

Heat of Reaction, Heat of formation, Hess's Law of constant heat summation, Experimental determination of heats of combustion, Kirchoff's equation Heat of solution. Heat Neutralization.

2. **Solution**: Effect of temperature and pressure on solubility, Supersatunation. Expressions for concentration of solutions (normality, molality, mol fraction) solution of gases in liquids, Henry's Law, partition co-efficient.

3. Physical Chemistry of dilute solutions :

Colligative properties - Osmotic pressure, Lowering of vapour pressure, elevation of boiling point, depression of freezing point - Raoult's Law, Different methods of determination of molecular weight - Association and dissociation in solution. Optical activity and chemical constitution, Refractivity and molecular structure.

4. Homogeneous equilibrium :

The Law of mass action - its applications - effect of pressure on chemical equilibria - Le-chatelier's theorem - some of its important industrial applications.

Theoretical basis of quantitive analysis :

1. Electrolytic dissociation.
2. The Law of mass action - its application to solutions of electrolytes.
3. Strengths of acids & bases.
4. Common ion effect.
5. Solubility product - Completeness of precipitation.
6. The ionic product of water - PH
7. The hydrolysis of salts
8. Buffer solutions.
9. Theory of Indicators.
10. Theory of Acid-base titration.

Chem, 202 Laboratory (3) II Common.

Acidimetry 1. (a) Preparation of approximately N/10 HC 1 and H^2 SO^4 solutions.

Alkalimetry : (b) Preparation of standard alkali solution and standardisation of the acid solution.

2. Determination of the amount of carbonate in a mixture of carbonate and caustic soda.

Oxidation Reduction Titrations.

3. (a) Preparation and standardisation of approximately N/10 $KMnO^4$ solution with standard sodium oxalate solution.

(b) Determination of Ferrous iron with standardised $KMnO^4$ solution.

(c) Determination of Ca in $Ca\ CO^3$.

4. (a) Preparation of standard $K^2\ Cr^2O^7$ solution and standardisation of approximately N/10 $Na^2S^2O^3$ solution.

Gravimtetric Analysis :

5. Determination of Fe as $Fe^2\ O^3$.

6. Determination of Sulphate as $BaSo^4$

Chem. 301(3) III C. E., M. E., & Met. E.

Corrosion : Its meaning. Importance of such study. Theories of corrosion of metals in gaseous environments. Corrosion of Metals in aqueous environments. Evidence in support of Electro-Chemical corrosion theory. Mechanism of corrosion, Corrosion in neutral solutions, corrosion by oxidizing acids, passivity of metals. Relative resistance of metals to galvanic corrosion, functions of oxygen in corrosion. Atmospheric corrosion. Mircobiological corrosion. Stray current corrosion. Stress corrossion. Grain boundary corrossion.

Prevention of Corrosion :-

1. Modification of the environment, in aqueous and acid solutions, use of inhibitors.

2. Modification of the properties of a metal.

3. Use of protective coatings :

(a) Metallic coatings.

(b) Non-metallic coatings.

(i) Inorganic-porcelain enamel, anodized, oxide coatings, chemical-dip coatings.

(ii) Organic protective coatings, Paints, varnish. enamel and lacquer.

4. Cathodic protection.

Chemistry of the following engineering materials will be studied : Cement, porcelain, glass, plastics, synthetic and artificial fibres, synthetic and natural rubber.

Chem. 303 (3) III Ch. E.

Physical Chemistry :-

A study of Equillibria of Homogenous and Heterogeneous Systems, Effect of Pressure and Temperature on the equillibrium constants, Criteria of Equillbria,

The Colloidal State. General properties of the colloidal system, Lyophilic and Lyophobic systems. The ultramicroscope Brownian Movement. Determination of partticle size, Electrophoresis. Electrical

Double Layer, Origin of charge. precipitation by electrolytes and its mechanism the Ultra-Centrifuge, Preparation of Colloidal Solutions. Emulsions and Gels.

Electrolytic Dissociation & Conduction Laws of Electrolysis, Electrochemical Equivalent, Conductivity.

Measurement of Conductivity and study of its applications, Speed of ions, Transport Number, Degree of Dissocition and Inter-ionic attraction theory.

Dialysis and kineties of chemical reactions.

Chem. 304 (Laboratory) (3) III Ch. E.

Phy. Chem. Lab. :- Determination of Molecular weights by

(a) Vapour density method

(b) Cryoscopy

(c) Ebullioscopy

(d) Osmotic Pressure

Distribution Law :

(a) Partition coefficient

(b) Molecular association or Dissociation

(c) Equillibrium constant of reactions.

Thermochemical Measurements

(a) Heat of reaction

(b) Heat of solution

Absorption from solutions

Viscosity and Density measurement

Experiment on polarimetry

Potentiometric titrations.

PH/measurment

Conductometric titration

Experiments on Refractometry.

Do on polarography

Do on spectrophotometry

Chem. 403 (3) IV Ch. E. & IV Met. E.

Physical Chemistry II :-

E. M. F. of a cell and Electrode potential. Ionic equillibrium, Ostwald's Dilution Law, Solubility Product, H Measurement. Hydrolysis, Strong and Weak Electrolytes, Activity, Acids and Bases, Indicators Buffer Action and Buffer Solution, Polarisation and Overvoltage.

Phase equillibrium-One Component System, Two Component System and Elementary treatment of Three Component System, Fractional Distillation, Distribution Law and Solvent Extrction

Colligative properties of solutions, Adsorption and its industrial applications and Catalysis.

Chem. 404 (3) IV Ch. E.

Physical Chemistry Laboratoroy :-

Practical experiments based on Chem. 40

Chem. 401(4) V Ch. E. (Organic chemistry)

A thorough knowledge of the Chemistry of Aliphatic and Aromatic comounds with special reference to :-

1. Polyhydric Alcohols-Glycol & Glycerol.
2. Fatty Acids and Derivatives-Acid Chlorides, Acid Anhydrides, Amides, Esters, Halogen, Amino and Cyano Acids, Hydroxy and Keto Acids.
3. Aliphatic Amines.
4. Sulphur Compounds.
5. Cyanogen Compounds.
6. Aromatic Substituted Halogen, Nitro and Amino Compounds.
7. Phenols.
8. Aromatic Alcohols, Aldehydes, Ketones and Acids.
9. A general idea of Multinuclear Compounds-Naphthalene and Grignard's Reagent.

10. Chemistry of cellulose and synthetic fibers.

11. A general idea of Heterocyclic compounds, dyes and Alkolides and drugs.

Chem. 502 (Laboratory) (3) V Ch. E.

Organic Chemistry Practical :-

1. Detection for the following elements qualitatively in an organic compound : Nitrogen, Sulpher, Halogens.

2. Detection of the following groups in an organic compounds :-

   $-NH_2$, $=NH$, ($-NH_2$ $=NH-N-CONH_2$).

   $-NO_2$, Halogens in the ring and in the side chain—SO_3H, —COOH. —OH, =CO etc.

   Aromatic Hydrocarbons.

3. Melting point determination of the compounds containing the above mentioned groups.

4. Preparation of the following organic compounds :

Nitro-benzene, Aniline, Benzoic Acid, Iodoform Acetanilide.

Chem. 505 (3) V Ch. E,

Inorganic Chemistry :—

Different types of Chemical Reactions :-

(a) Decomposition

(b) Synthesis

(c) Photo-chemical re-action

(d) Metallic bond

(e) Exchange reaction

(f) Dissociation

(g) Association

(h) Disproportionation

(i) Induced Reaction,

Chain reaction, Resonance, carbides of metals and Larthamide contractions and their effects·

and

(l) Special treatment of oxidation-reduction reactions. Oxides and Hydroxides, Modern views about acids and bases.

Brief study of the comparative Chemistry of the following groups of elements in the periodic Table with reference to : (a) discovery, where required, (b) occurence, (e) general methods of preparation, (d) properties and uses of the elements and their important compounds,

(i) Group III Particular reference to B and Al.

(ii) Group IV Particular reference to C, Si, Ge, Sn, Pb.

(iii) Group V Particular reference to N & P.

(iv) Group VII Halogens and Mn.

Transition elements

Oxides and oxyacids of :

Nitrogen, phosphorus, sulphur and halogens.

Complex compounds with refrence to the following : Classification, Werner's Theory and modern electronic interpretation of the structure, Isomerisn in 6 co-ordinated complexes.

Chem. 506 (Laboratory) V. Ch. E.

Inorganic Chemistry Practical—

Volumentric Analysis.

(a) Determination of Na_2 Co_3 content of washing soda.

(b) Determination of ferrous and ferric Iron by using internal indicators.

(c) Preparation and standardisation of Sodium thiosulphate Solution.

(d) Titrations involving determination of Ag & chloride by volhards method.

(e) Estimation of (i) Iron (ii) Zn (iii) Sn & (iv) sulphate gravimetrically.

(f) Quantitative analysis of Brass, Bronze and cement.

Preparation of typical Inorganic Compound :

Text books

(i) Quantitative Inorganic Analysis—Vogel.

(ii) Quantitative Analysis by W. C. Pierce & Hamoisch.

Chem 507 (2) V E. E.

Chemistry of Engineering.

Crystal structure, molecular structure of matter and physical properties, crystal defects and semi-conductivity, Quantum theory of matter, Electronic of valency and different bond types. Oxidation-Reduction reactions, and Electrode potentials, corrosion and its prevention.

The nature of the metals and alloys. Chemistry of the following : water, Heavy water, seleium, Teleurium, Boron, Carbon, Silicon' Germanium, with special reference to their structure and properties. And also Chemistry of plastics, ceramics, (porcelain, glass, refractories,) rubber (synthetic and natural) and cement is to be studied from the point of view of manufacture, properties and uses in industries.

Metallic bond, resonance and photochemical reactions.

Chem. 701 (2) VII Ch. E.

Nuclear Chemistry :—

Discovery of Radioelements ; Nature of Radioactive Emission; Theory radioactive disintegration and Group Displacement Law; Radioactive decay and radioactive series; Packing fraction, Measurement of radioactivity ; Radioisotopes, their separation and application ; Nuclear reactions and trans-

mutation of elements; Energetics of Nuclear reactions : Production of Nuclear particles; cyclotron and betatron ; and Nuclear fission and its control atomic reactor.

CHEMICAL ENGINEERING DEPARTMENT

Details of Chemical Engineering Courses

Ch. E. 301 (3) Fluid Flow I—III Chem. E.

Fluids and their properties ; Fluid statics ; Manometry, Flow of fluids; Steady flow, equation of continuity; Bernoullis' equation, total energy balance; Real fluids, Laminar and turbulent flow, velocity distribution ; Friction force and energy loss ; Fluid flow in pipes ; Funda mental equations and pipe friction calculations; Measurements of fluid flow.

Ch. E. 303 (3) Industrial Stoichiometry I—III Chem. E.

An introduction to the psychrometric calculations, An introduction to the calculation of mass balance, energy balance and the combination of mass energy balance involved in combustion and other industrial processes.

Ch. E. 304 (3) Industrial Stoichiometry I (Laboratory) -III Chem. E.

Extensive problem work based on Ch. E. 303.

Ch. E 401 (4) Heat Transfer - IV Chem. E.

Principles of heat transmission by conduction, convection and radiation, Heat transfer during change of phase ;

Design and operation of heat transfer equipment; Evaporation and Heat transfer through fluidised beds.

Ch. E. 404 (3) Industrial Stoichiometry- II (Laboratory - IV Chem. E.

Extensive problem work based on Ch. E. 304

Ch. E. 405 (2) Fluid Flow II- IV Chem. E.

Transportation of fluids ; pumps; blowers ; fans compressors. Flow through porous beds; Filtration ; types of filters, Flow through fluidized beds; batch fluidization and boiling beds; continuous fluidization and pneumatic transport.

Ch. E. 501 (4) Mass Transfer I-V Chem. E.

Unit Operations involving Mass transfer ; Distillation Gas absorption ; Extraction.

Ch. E. 502 (3) Mass Transfer (Laboratory)- V Chem. E.

Problem work based on Ch. E. 501 and Laboratory Work based on Ch. E. 301, Ch. E. 401 and Filtration.

Ch. E. 503 (3) Chemical. Process Analysis I-V Chem. E.

Study of Fuels & their utilization in Industrial processes and the following industries with special reference to the stoichiometry, unit operations and unit processes involved, design and construction of equipment,

its operation and maintenance as well as flow sheet and plant lay out : Alkali industries, acid industries, chlorine, bleaching powder, ammonia, fertilizers, lime, cement, ceramics, and other important inorganic industries.

Ch. E. 505 (2) Chemical Engineering Thermodynamics I-V Chem. E.

Fundamental concepts of thermodynamics ; First law of thermodynamics as applied to both batch and flow processes ; Equilibrium and the phase rule, phase relations ; Heat capacity and heat of reactions ; Properties of materials, phase diagram, energy relations of perfect gases, and Generalized P. V. T. relations.

Ch. E. 507 (3) Chemical Engineering Kitnetics - V Chem. E.

An introduction to the kinetics of reaction and the application of fundamental principles to the design and operation of commercial reactors; The rate of reaction, Factors affecting the rate of reaction; The order of reaction, Arrehenius equation, Reactor design, classification of reactors, Batch and Flow reactors for homogenous systems ; catalysis, nature of catalytic reactions and general behaviour of catalysis.

Ch. E. 601 (4) Mass Transfer II - VI Chem. E.

Unit Operations involving simultaneous heat and mass transfer such as Humidification, Dehumidification, Water cooling and Drying, (Crystallization.)

Transport Phenomenon Unified concept of Momentum, Energy and Mass Transport.

Ch. E. 601 (6) Mass Transfer II- VI Chem. E.

Problem work based on Ch. E. 601 and Laboratory work based on Ch. E. 501, Ch. E, 601 and Size reduction.

Ch. E. 603 (3) Chemical Process Analysis II- VI Chem. E.

Continuation of Ch. E. 503. The following industries will be studied:

Cellulose industries. Cellulose esters, Pulp and paper: Starch and starch products: Sugar, Nitrogenous organic compounds, Rubber, Plastics, Petro-chemicals, Oils and fats and other important organic industries.

Ch. E. 604 (3) Chemical Process Analysis II (Laboratory)- VI Chem. E.

Laboratory and problem work based on Ch. E. 503 and Ch. E. 603

Ch. E. 605 (2) Chemical Eengineering Thermodynamics-II VI Chem. E.

Elementary applications of the second law of thermo-dynamics and its limitations will be considered, Specific topics will include cyclic processes, work effects, free energy, fugacity, enthalpy, entropy, internal energy, Effect of pressure, volume and temperature upon the thermodynamic Properties of substances-

Ch. E. 606 (3) Chemical Fngineering Thermodynamics (Laboratory)- VI Chem. E.

Extensive problem work based on Ch. E. 605.

Ch. E- 607 (3) Unit processes-VI Chem. E.

A study of selected Unit processes from the following list :

Halogenation, esterification, nitration, polymerization. hydrogenation, hydrolysis, ammonolysis, diazotization and coupling, oxidation. alkylation and pyrolysis and the equipment required for them.

Ch. E. 700 (6) Project-VII Chem. E.

With the assistance of a teacher the student will select a problem in any field of Chemical Engineering. The problem must require exprimental work and not be merely a paper thesis, and must be sufficiently limited in scope so that the student can expect to attain a satisfactory solution in one year of work. The purpose of this course is to make the student responsible for planning and carrying out an engineering project and presenting his work in an acceptable engineering report.

Ch. E. 701 (3) Process Control and Iustruments—VII Chem. E.

A study of fundamental principles and methods used in the measurement and control of the process variables such as pressure, temperature and flow-rate ; Modes of

control ; Elements of control ; Automatic control mechanism ; Control system applications in chemical industries.

Ch. E. 702 (3) Process Control and Instruments (Laboratory) —VII Chem. E.

Laboratory work and problems on Ch. E. 701.

Ch. E. 703 (2) Plant Design I—VII Chem. E.

Integrated design of chemical plant of particular importance in the scheme of national development from the viewpoint of both chemical engineering and economics. This will be a group undertaking with special emphasis on teamwork, initiative, resourcefulness; and leadership.

Ch. E. 704 (3) Plant Design (Laboratory) I - VII Chem. E.

Design problems based on Ch. E. 703.

Ch. E. 705 (3) Chemical Engineering Thermodynamics III—VII Chem. E.

Expansion and compression of fluids ; Differential energy balance ; Shaft work in flow and non-flow processes, Isothermal flow and non-flow expansion ; Free expansion, Joule-Thompson expansion; Maxwell expansion ; Cyclic processes, power cycles. Compression of gases; single stage and multistage compression ; Refrigeration, compression refrigeration and absorption refrigeration ; Low-temperature liquefaction of gases ; Vapour recompression and evaporation.

Ch. E. 708 (5) Unit process (Laboratory)—VII Chem. E.

Laboratory work and problems based on Ch. E. 607.

Ch. E. 709 (2) Corrosion and Materials of Construction I VII Chem. E.

Principles of corrosion : corrosion cells ; corrosion tendency and rates and Polarization ; Types of corrosion. Principles of corrosion prevention ; Passivity; Cathodic protection ; Inhibitors, Paints and Coatings.

Ch. E. 800 (8) Project and thesis—VIII Chem. E.

Continuation of Ch. E. 700.

Ch. E. 803(2) Plant Design II-VIII Chem. E.

Continuation of Ch. E. 703.

Ch. E. 804(5) Plant Design (Laboratory) II-VIII Chem. E.

Continuation of Ch. E. 803.

Ch. E. 809 (2) Corrosion and Materials of construction II-VIII Chem. E.

Study of chemical plants and equipment of cast iron, steel ; stainless steel ; alumunium ; copper ; tin; lead zinc ; nickel ; nickel alloys ; silver; brass ; bronzes ;

chemical stoneware ; enamels ; glass ; wood ; rubber ; plastics ; refracto ement concrete ; clay and clay products.

Ch. E. 811 (3) Technology of Petrolieum and Petro-Chemical - VIII Chem. E.

A study of general principles, unit operations, unit prcesses and equipment used in Petroleum Refining including nature of petroleum and its fractions ; Operations of thermal and catalytic cracking, stabilization, alkylation and isomerization ; problem covering synthesis of petro-chemicals and related materials.

Ch. E. 812 (3) Petroleum Refining (Laboratory)—VIII Chem. E.

Laboratory work based on Ch. E. 811.

Or,

Ch. E. 813(3) Technology of Pulp and Paper-VIII Chem. E.

Fundamentals of pulb and paper manufacture with emphasis on recent advances in the filed, including operations, processes, and equipment.

Ch. E. 814 (3) Technolgy of pulp and paper (Laboratory) VIII Chem. E.

Laboratory work based on Ch. E. 813

Or

Ch. E. 815(3) Technology of Plastics– VIII Chem. E.

The properties, methods of manufacture and application

of synthetic resins and related polymers, including recent development in the field.

Ch. E. 816 (3) Technology of Plastics (Laboratory)—VIII Chem. E.

Laboratory work based on Ch. E. 815

Or,

Ch. 817 (3) Food Technology—VIII Chem. E.

A study of unit operations, processes and equipment used in food technology.

Ch. E. 818 (3) Technology of Food (Loboratory) VIII Chem. E.

Laboratory work based on Ch. E. 817,

Ch. E. 819 (3) Technology of Fuels and Gas-VIII Chem. E.

Coal and the other fossil fuels, Fuels derived from coal: Petroleum and Shale oil fuels; gassous Fuels ; the chemical priciples and heating effect of combustion and gasification; cumbustion of Solid fuels in practice; Stoking and boiler operation, Pulvarized fuel, boiler auxiliary plant ; Water treatment ; Gas producers: Furnance - general principles, construction and special types ; Waste heat recovery ; Refractory and insulating materials : Space heating ; Sampling of fuels : Analysis of fuels, Selection of fuels and economic considerations.

Ch. E. 820 ( ) Technology of Fuels and Gas (Labotatory) —VIII Chem. E.

Laboratory work based on Ch. E. 819.

CIVIL ENGINEERING DEPARMENT

C. E. 101 Surveying. **1 Credit.**

Use of instruments and their adjustments. Levelling ; contouring ; Traverse survey : compass, plane table & Theodolite. Preparation of survey maps.

C. E. 102 Survey Practical based on **(30)**

C. E. 101 Two weeks filed course

C. E. 201 Surveying **1 Credit.**

Continuation of CE 101.

C. E. 301 Machanics of Materials **4 Credits.**

Review of Hook's law, transverse deformation, poisson's ratio. Machanical properties of materials ; stress-strain diagrams of ductile and non-ductile materials, effect of over-stress, cold working, effect of repetition of stress fatigue and creep.

Stress in members of variable cross-sections, localised stress, temporary stress, shear stress, caused by tension and compression, shear stress on mutually perpendicular planes.

The nature and causes of failure of members allowable and working stresses.

Bending moment and shear force diagrams of statically determinate beams under different conditions of loading. Stresses in beams of different symmetrical cross-sections due to bending and shear.

Stresses in short and slender columns, Eule's formula.

Torsion of circular shafts : stresses and deflections of helical springs.

Stress in thin cylinders.

C. E. 303 Surveying **2 Credits.**

Use of instruments and their adjustments levellin, contouring, traverse and plane tabling ; applications in topographic survey and mapping.

C. E. 305 Elements of Framed Structures **3 Credits.**

Non-coplanar forces, condition of equilibrium of non-coplanar forces, Stress analysis, tripods, cranes, frames, Deflection of trusses by Willot Mohr Diagram. Common types of trusses. Analytical and graphical analysis of roof and bridge trusses both.

Riveted and welded joints. Reveted joints in structural works. Allowable loads in beam connections. Plate griders.

Timber construction, wood structures, structural timber classification, holding power of nails and screws, bolted joints in timber.

C. E. 306 Structure (Sessional) 3 Credits.

Based on C. E. 305.

C. E. 413 Engineering Materials 3 Credits.

Bricks & Tiles-method of manufacturing & their classification and specification.

Source, classifications and specifications of sand, lime, cement and concrete.

Different kinds of mortars, Plasters and concrete—preperation : white washing-preperation and application.

Timber—Classification of trees, growth of wood, decay, durability, seasoning and preservation.

Ferrous Metals-Carbon steel and alloy steel and their physical and mechanical properties, Corrosion and protection.

Plastic materials, rubber, paints, varnishes.

C. E. 414 Engineering Materials 3 Credits.

Physical tests of cement, sand, aggregate and concrete. Design of concrete mix. Testing of R. C. beam, colums.

C. E. 307 Geology **3 Credits.**

Physical Geology : Weathering, erosion by rivers, wind, sea and glacier, Principles of structural Geology. Study of common minerals and rocks with their relationships and applications to construction, foundations and excavation. Pakistan Stratigraphy, Principles of Geology as applied to the construction of highways, bridge abutments and piers, dams and reservoirs. Tunnels, and stability of hill slopes. Quarrying. Test boringsand their interpretation with simple information on fossils. Igneous, Sedimentary and metamorphic rocks.

C. E. 310 Drafting **3 Credits.**

Drawing of (i) a building (ii) a bridge and the detailling of the different parts of the structures.

C. E. 401 Strength of Materials **3 Credits.**

Deflection of statically determinate beams, bendings, moments, shear forco diagrams and calculations of deflections of restrained and continuous beams. Combined stresses, principal stresses and strains, Mohr's circle; relation between elastic constants. Beams of variable cross-setions and different materials. Elastic straim energy due to direct load and bending, resilence stresses due to gradually, & suddenly applied and falling loads ; leaf springs. Stresses in a beam or column of unsymmetrical cross-sections : kern of section, shear centre

C. E. 402 Strength of Materials (Laboratory) 3 Credits.

Determination of strength ductility, modulus of elasticity and other properties of timber, steel, cast iron and concrete.

Torsin. bending and hardness tests and effect of rate of loading.

C. E. 403 Estimating & Costing 3 Credits.

Interpretation of working drawings and detailing of earth work in foundations, timbering, shoring, scaffolding & underpining. Masonry, concrete and reinforced concrete works and their form works Retaining walls, arches, carpentry and timber works and their analysis and costing.

C. E. 405 Basic Fluid Mechanics 3 Credits.

Fluids and their properties, fluid statics, pressure versus pressure intensity with elevation, absolute and gage pressure, manometry forces on submerged plane and curbed surfaces, Buoyancy and floatation, fluid masses subjecedt to accleration.

Fundamentals of fluid flow. Ideal fluids, path lines, stream lines and stream tubes, discharge, steady flow, uniform flow, continuous flow, energy and heat, rotational and irrotational flow, significance of the flownet, continuity relationship, Bernoullies equation.

Real fluids. Liminer and Tarbulent flow, friction force and energy loss, velocity distribution and its significance.

Fluid measurement : Measurement of static pressure, surface elevation, stagnation pressure. Velocity, anemometers and current meters, different devices for measuring rate of flow.

C. E. 407 Geodesy & Photogrametry **3 Credits.**

Highway and Railway reconnaissance. Horizontal and Vertical curves.

Engineering astronomy—system of co-ordinates, sun and mean time and finding time by sun and star, astronomical corrections.

Introduction to pho ogrammetry, telescopic study and interpretation of air Photographs and photographic procedure.

C. E. 408 Geodesy Practical

Practical Geodesy based on 407

C. E. 409 Theory of ructur s **3 Credits**

Introduction to structural f rce system. Live loads, influnce lines and critria for maximum bending moment,

shear force an ' stresses in statically determenate members, statically determenate beams, trusses, and trusses with floor beams. Calculations of roversal stresses in web members. Non-parallel chord trusses, trusses, without verticals, subdivided trusses.

C. E· 411 Details of Construction **2 Credits**

Loads on Structures and bearing power of soils. Preleminary investigation and examination of soil. Foundations of structures. Stone masonry and. brick masonry. Types of bond, tupes of walls and stresses in brick masonry. Framed structures and bearing walls, Arches, lintels, joinery of wood doors and windows. Details of floors and roofs. Pointing plastering and interior finishing. Concrete-plain and reinforced. Structural steelwork. Scaffolding, staging shoring and underpining. Thermal insulation and acoustics.

C. E. 501 Plain & Reinforced Concrete **3 Credits**

General principles of reinforced concrete. Physical properties of concrete, proportioning for strength. Stress strain. relation Shrnikage and creep and their effect.

Theory of rectangular beams. slabs. tee-beacs Shear and bond.

C. E. 503 Soil Mechanics **3 Credits.**

Introduction to Soil Mechanics and its aplication to the problems encountered in Civil Engineering ,

Origin of Soil, Classification and identifications of Soil, Physical properties of Soils, Weights, Compaction of Soil, Stress and heads, permeability of Soil, Seepage, Capillarity, Stress-Strain characteristics of Soil, Consolidation, Shearing Strength of Soil ; Subsurface investigation.

C. E. 504 Soil Mechanics (Laboratory) 3 Credits.

Visual indetification of Soil. dctermination of Unit weight. Specific Gravity Sieve analysis. Atterberg limit test : Liquid limit, plastic limit. Shrinkage limit. Direct shear test. Compaction test. Unconfined compression test.

C. E. 505 Hydralics 3 Credits.

Measurement of rate of flow, Venturi meters, nozzles orifices. flow bends, weires, pitot tubes, Review of Bernoullis equation, flow through pipes. analysis of velocity, losss of head, loss of head due to pipe friction, wetted perimeter and hydraulic radius, hydraulic gradient and energy gradient, minor losses, pipe connecting two reservoirs, pipes of different diameters connecting in series, branch flow and pipe line with pumps, stability, of floating bodies, forces on gravity dams.

Open Channel: Uses of open channel and hydraulic radius of open channel uniform flow, Chezy formula, alternate stage of depth, critical flow, cross section of greatest efficiency. Channel, obstruction, &

bends, velocity distribution in natural streams, hydraulic similitude and dimensional analysis, hydraulic jump and back water curve (Introductroy).

C. E. 506 Hydraulics (Laboratory) 3 Credits.

Based on C. E. 405 & C. E. 505.

C. E. 508 Design & Drawing 3 Credits

Studies of plan & lay out residential buildings; one storied bungalow type, two storied and flat type, public buildings such as, hostels, hospitals, schools etc. and of the project of a model town or a University town; and to make their Engineering drawing.

C. E. 509 Theory of Structures 3 Credits.

Selection of site for bridges, embankments. Analysis and design of bridge, with special emphasis on Highway bridges under the action of vertical dead and live loads, and of wind forces. Foundation of bridges, Protection of embankments, abutments, piers etc.

C. E. 510 Structure Sessional 3 Credits.

Design drafting of a plate girder bridge and an R. C. beam bridge.

C. E. 511 Theory of Structures 3 Credits.

Elementary design of simple beams, ties, columns and trusses. Design of concrete mix, R. C. slabs, beams and columns for static and live loads.

C. E. 601 Reinforced Concrete Structures 3 Credits.

Review of design of beams. Analysis and design of contineous beams, columns—eceentric and concentric, footings single and compound. Two way and flat roof systems.

C. E. 60 Reinforced Concrete Structures Sessonal 3 Credits.

Syllabus based on C. E. 501 & C. E. 601.

C. E. 603—Soil Mechanics & Foundation Engineering 3 Credits.

Theory of Earth Pressure ; stability of retaining wall & Stability of slopes, bearing capacity of shallow footings, piers and piles ; Types selection and construction of foundations. Design of different typ s of foundations. Flooring, Raft, Pils, piers.

C. E. 604 Soil Mechanics & Foundation Engineering (Laboratory) 3 Credits.

Hydrometer analysis. Permeability test. Determination of field density of soil. Relative density. C. B. R. test. Triaxial test and evaluation of angle of internal friction. Consolidation test.

C. E. 605 Hydrology 3 Credits.

Introduction, The general circulation, Temperature, Humidity, Wind, Precipitation, Stream flow, Evaporation and transpiration, Ground-water, Characteristics of the hydrograph. Run-off relations. Hydrographs of runoff. Streamflow routing, Frequency and duration study,

C. E. 607 Railway Engineering 3 Credits.

Reconnaissance survey, preliminary survey, choice of alignment and final location survey ; formation ; bank and cutting, land width, drainage : grades and curves, ruling gradient, transition curves, realignment of curve resistance ; superelevation : permanent-way : rails, sleepers ; and fastenings ; ballast ; fatigue of rails, creosoting of sleepers ; construction ; station and yard.

Methods of laying new tracks and renewal of existing tracks, tools and plants required, arrangements of materials : points and crossing, signal and interlocking ; level crossings, maintenance, methods of maintaining track, tools and plant, labour, common types of railway bridges, their maintenance and inspection ; repairs and renewal including temporary arrangements.

C E. 609 Theory & Design of Structures 3 Credits.

Analysis of industrial building bents with knee brace, multiple-story bent, tall buildings. Analysis and design

of building structures by the approximate method under the action of vertical dead and live loads and of wind, earth and like forces. Building code and structural requirements for the use of timber, steel and bricks

C. E. 610 Structure Sessional **3 Credits.**

Design drafting and costing of a multistoried building by the approximate method.

C. E. 700 Project & Thesis **9 Credits**

Experimental or design report of any engineering subject or project.

C. E. 701 Water Supply Engineering **3 Credits.**

Sources of water, consumption of water for various purposes, factors affecting consumption ; variations in the rate of consumption, Fire demand, population estimate, impurities present in water, Drinking water standards, types of treatment process, Distribution systems, common types of pipes for conveyance of water. Simple Principles of water treatment. Planning and design of a small water works.

C. E. 702 Water Supply Engineering (Laboratory) **3 Credits.**

Physical, chemical and bacteriological examination of water and sewarage based on C. E. 701.

C. E. 703 Irrigation **3 Credits.**

Introduction, irrigation soil, soil fertility, saline and alkali soil, basic soil and water relations, soil moisture relationship, sources of irrigation water, quantity of irrigation water, conveyance of irrigation water, transit losses, Irrigation from wells, Irrigation methods, measurement of irrigation water, duty of water, Time of irrigation, the flow of water in soils, consumptive use of water, storage reservoir. Navigation, canal cross drainage work, irrigation projects and their feasibility ; A brief study and design of hydraulic structures,

C. E, 705 Hydraulic Engineering **3 Cerdits,**

Steady uniform flow in open channel, stationary hydraulic jump in channels of rectangular cross-section, hydraulic jump in channels in non-rectangular cross-section, moving hydraulic jump, backwater curve, significance of Eurler number. Froude number and Reynold's number, viscous resistance of fluids. waves and surges.

C. E. 706 Hydraulic Engineering (Sessional)

Based on C. E. 505 & 705.

C. E. 707 Highway Engineering **3 Credits.**

Highway planning, location survey choice of alignment ; Traffic Elements, Design speed, highway—capacity; Elements of design—sight distance, horizontal alignment, vertical alignment, Trasition curve, superelevation ; cross-section

elements-pavement, lane width, curb, shoulder, pavement. crown, medians and highway drainage ; Intersection-Turning radius and horizontal sight distance, Islands and channelization, grade separation and interchanges.

A study of vehicle operating characteristics, Traffic survey, Traffic flow, Assignment of traffic for design purposes, methods of traffic control.

C. E. 709 Structural Analysis & Design 3 Credits.

Methods of angle changes in loaded beams and their applications. Redundant members and deflection of trusses. Influence lines for continuous beams and two span trusses, two-hinged arches, ribbed and spandrel braeed, Reciprocal ations, Maxwells law, Muller Breslaus principles.

Introduction to suspension bridges.

C. E. 710 Structura analysis & Design (Sessional) 3 Credits

Design, drafting and costing of cantilever, continuous and rigid frame bridges.

C. E. 800 Project & Thesis 9 Credits

Cont nation of C. E. 700

C. E. 801 Sewcrage Engineering 3 Credits

Sewerage, Sewer and Sewerage systens, sources of sewage separate and combined sewer systems, common types of sewer sections, appurtanaces, simple principles of seweragae treatment and methods of sewage disposal, planning and design of a small sewage treatment plant.

C. E. 803 Drainage & Flood Control 3 Credits

Drainage system in irrigated land ; Drainage of surface run off, ground water movement, theory of land drainage, by pumping.

Floods : Causes of floods, remedies, flood prevention, flood diversion, floods idcluding its behaviour in tidal areas, meandering of rivers, erosion and siltation, improvement of channel cross section, discharge improvement, cut—off and its effect, methods of making cut—offs, bank, diversion of floods, flood proofing techniques, reclamation bundle, spur, groyne, guide banks, jungle or brush wood matreseing, encased brick-matressing, levees and its effects, flood frequency study, flood rounting ;

A brief study and design of hydraulic structures,

C. E. 805 Hydraulic Engineering 3 Credits.

Impact of water, work done on vanes, reciprocating centrifugal pumps, petlton wheel, impulse turbines, reac-

tion turbines, principles of dynamic similarity for turbines, selection of type and speed of turbines and pumps, specific speed efficiency.

C. E. 806 Hydraulic Engineering (Sessional) 3 Credits.

Design of Hydraulic structures.

C. E. 807 Highway Engineering Credits.

Highway Soil Engineering, soil classification and soil survey or highways moisture-density-relationship ; Evaluation of properties of mineral aggregates-grading, resistance to abrasion, soundness, cleanliness and purity, Internal friction and surface properties; Bituminous materials; origin, production, type, properties, tests, and specifications ; Asphalt surface treatments and seal coat, road mix and plant mix surfaces ; Soil-aggregate roads and soil stabilization, Brick and block pavements, mecadam roads ; Structural design of flexible and rigid pavements-stress analysis in flexible pavement, CBR method of design. Triaxial method of design, Theory and design of rigid, pavement, construction and maintence.

C. E. 808 Highway Engineering (Laboratory) 3 Credits.

Based on the Syllabus of C. E. 807.

C. E. 809 Theory and Design of structures 3 Credits.

(a) Introduction to moment destribution, sedisway, analysis of rigid frames by column analogy.

(b) The principles of Pre-stressed concrete, materials used, pre-stressing systems, losses : analysis and design of simple statically determined beams.

C. E. 810 Structures (Sessional) 3 Credits

Based on the Syllabus of C. E. 709 & C. E. 809.

DRAWING AND DRAFTING

Drg. 102 (6) Engg. Drawing 1 Credit.

Parallel projections: orthographic and exonometric. Isometric projections. Development of surface of solids sections and interpenetration of solids. Sectional views. Freehand drafting of orthographic and isometric views on spuared paper from sketches and models of engineering structures.

Principles of working drawing, techniques and functions, selecion of views, order of drawing the views, modified views, conventional violations of rules of projection.

Scale drawings or orthographic and isometric views from sketches and models of engineering structures

Drg. 202 Engg. Drawing 3 Credits.

Working drawings of engineering structures with perspective views.

DEPARTMENT OF ELECTRICAL ENGINEERING

Hrs/week

E. E. 201 Basic Electrical Engineering

2nd Semester Common.....3

Fundamentals of electrical concepts & units, electric networks, practical measurement of electrical quantities, magnetic concepts & units, introduction to magnetic circuits, Electromagnetic forces.

Alternating currents-series-parallel and series parallel circuits.

E. E. 202 Basic Electrical Engineering

2nd Semester Common.....3

Laboratory

Based on E. E. 201

E. E. 300 Electrical Drafting

3rd Semester (Elect).....3

(Sessional)

Electrical and Electronic Symbols, Wiring Diagrams and Block diagrams, Electronic Schematic diagrams and Industrial Electronic Diagrams, Electrical power wiring diagrams for work-shops, commercial establishments, dwelling houses etc.

Electrical drawing for architectural plans.

H/week

E. E. 301 Electrical Technology

3rd Semester (Civil)...3

Alternating current circuits single & polyphase-ammeter. voltmeter & wattmeters.

D. C. Generators & motors—Transformers, synchronous and induction machines.

Thermionic valves - Cathode Ray Oscilloscope,

E. E. 302 Electrical Technology

3rd Semester (Civil)...3

Laboratory

Based on E. E. 301

E. E. 303 Electrical Circuits I

3rd Semester (Elect.)...3

Phasors ; General approach to Circuits ; Basic wave forms, Ideal voltage and current sources, step function and Impulse function. Response of single elements to ideal sources, Response of Circuits, source-free and with sources. Sinusoidal single-phase CKT analysis ; coupled circuits, polyphase circuits (balanced and unbalanced), circuit theorems with applications.

Hrs/week

E. E. 304 Electrical Circuits I

3rd Semester (Elect.) ...3

Laboratory

Based on E. E. 303

E. E. 400 Electrical Shop

4th Semester (Elect.).....3

(Sessional)

Splicing & Soldering circuit tracing and simple house wiring ; armature winding study and its connections. Simple lighting fixturs-operation and study ; Battery Charging, Earth Testing Trouble shooting & Repairing of M/C.

E. E. 401 Electrical Engineering

4th Semester (Mech. Chem. & Met)... 3

Polyphase circuits, Synchronous machines, Polyphase induction motors-fractional horse-power motors, Transformers and Switchgear.

E. E. 402 Electrical Engineering

4th Semester (Mech. Chem. & Met.).....3

Laboratory

Based on E. E. 401

Hrs/week

E. E. 403 Electronics I

4th Semester (Elect.).....4

Electron Ballistics & Simple Applications.

Electronic energy relations, current in metals. Semi-conductors and insulators, electrons and holes, N-and P-Type materials, surface energy barrier, work function, thermionic emission, high field emission, photo-emission, secondary emission.

Diode, its characteristics ; Power supplies and power supply filters.

Triode characteristics, equivalent circuits, analysis of triode circuits.

Tetrodes ; Pentodes : Beam tubes ; Variable-mu tubes. Basic Vacum tube amplifier configurations and their analysis. Input admittance, noise sources in Vacuum tube circuits.

Untuned voltage amplifiers.

E. E. 404 Electronics I

4th. Semester (Elect).....3

Laboratory

Based on E. E. 403

E. E. 405 Electrical Machines I

4th emester (Elect.).....3

DC Machines : Dynamo principles & construction, Emf eqn., armature reaction, commutation compensation. Characteristics of DC Generators & Motors. Torque & Speed eqn. Application of DC machines as elements of control systems.

Transformer : Construction, Emf eqn. Equivalent circuits. Tests on transformer, Parallel operation of transformers. Polyphase connections.

E. E. 406 Electrical Machines I

4th Semester (Elect.).....3

Laboratory

Based on E. E. 405

E. E. 500 Electronics Shop :

5th Semester (Elect.).....3

Laboratory

Radio receivers-Study & circuit tracing, fault finding by signal injection and other means, alignment ; Trouble shooting of C. R. O. 's Amplifiers.

Hrs/Week

E. E. 503 Electrical Circts II

5th Semester (Elect).....4

Transient conditions, non-sinusoidal waves : Fourier transforms ; Laplace transformations, Heaviside expansion theorem, convolution Integral, application to electrical circuit problems. Matrix with simple application in circuits ; Network function, poles and zeroes of a network. Electric wave filters.

E. E. 504 Electrical Circuits II

5th semester (Elect.)...

Laboratory

Based on E. E. 503

E. E. 505 Electrical Machines II

5th Semester (Elect.)...4

Rotating AC Machines—Induction machines –Operation, analysis, equivalent circuits. test data, Circle diagram. Starting & Speed control, synchronous Machines-Salient-pole & non-salient pole machines. Theory, operation and applications. Synchronous motors, its characteristics and dynamics. Parallel operation and load sharing of AC generator.

E. E. 506 Electrical Machines II

5th Semester (Elect.)...3

Laboratory.

Based on E. E. 505

Hrs/week

E. E. 507 Electrical Measurements

5th Semester (Elect.).....3

Measurement of low, medium & high resistances, measurement of self-and mutual, inductance & capacitance, AC bridge methods. Magnetic measurements flux meter & ballistic galvanometer. Separation of iron losses.

Measuring instruments : Classification, working & construction of voltmeters, ammeters & wattmeters. Instruments Transformers, Energy meters. Introduction to electronic measuring instruments.

E. E. 508 Electrical Measurements

5th Semester (Elect.).....3

Laboratory

Based on E. E. 507

E. E. 601 Applied Electronics

6th Semester (Mech. Chem & Met.).... 3

Interpretation of circuit diagrams—Themionic valves, Rectification, amplification, oscillator.

Hrs/week

Cathode ray oscilloscope—Photo cells—Electrical methods of measuring temperature and strain.

Gas tubes — Thyratrons — Ignitron — Powersupplies — Electronic method of speed control of motors.

E. E. 602 Applied Electronics

6th Semester (Mech. Chem. & Met.) ...3

Laboratory

Based on E. E. 601

E. E. 603 Electronics II

6th Semester (Elect).....3

Tuned Voltage Amplifiers.

Effects of feed back on amplifier characteristics. Types of feed back, Stability, Inverse feed back circuits, Nyquist criterion. Direct coupled (D. C.) amplifiers ; Voltage Regulators.

Untuned Power Amplifier ; Class A, Class AB., Class B., Push pull Amplifiers, Phase inverters.

Tuned class B and class C Power amplifiers.

Conditions for self oscillation. Influence of mutual

Hrs/week

conductance ; Study of different types of oscillators.

E. E. 604 Electronics II

6th Semester (Elect)... ..3

Laboratory

Based on E. E. 605

E. E. 605 Electrical Machines III

6th Semester (Elect.) 3

General Principles of Electro -Mechanical Energy Conversion—Energy storage method of formulation of equations of motion of electric-mechanical systems. Step and frequency response. Equivant circuits block diagrams. Single phase machines.

Mercury are rectifiers and Rotary converters.

E. E. 606 Electrical Machines III

6th Semester (Elect.).....3

Laboratory

Based on E. E. 605

E. E. 607 Control Systems :

6th Semester (Elect.).....3

Introduction to linear feedback control systems. Open

Hrs/week

—loop and closed-loop sytems. Transfer functions. Block diagrams. Step and frequency response. Nyquist and Bode—plots. Stability criteria and other performance characteristics of closed—loop systems. Introduction to synthesis and compensation.

E. E. 608 Control Systems

6th Semester (Elect.).....3

Laboratory

Based on E. E. 607

E. E. 609 Electromagnetic Eields I

6th Semester (Elect) ..3

Electrostatics: Coulombs law, Force, Electric field intensity, Electric flux density, Gauss's theorm and application, Electrostatic potential, Boundary conditions, Energy in Electrostatic system.

Magnetostatics: Concept of magnetic field, Ampere's Law.

Biot - Savert law; vector magnatic potential; Energy in magnetic field. Solution to static field problembs.

Graphica field mapping ;

Hrs/Week

Solution to Lap-lace's Equation – rectangular, Cylindrical and spherical harmonic.

Time varying fields, and Maxwell's equations. Relation between circuit theory and field theory. Elements of plane wave propagation and reflection.

E. E. 611 Nuclear Engineering :

6th Semester (Elect.)...3

Review of Nuclear Physics: Binding Energy, Nuclear Reactions, Neutron cross section. Nuclear Fission, Energy release from. Fission.

Nuclear Chain Reactor; Moderators, Critical Mass. Control and cooling. Classification of Reactors, Brief description of different types of Reactors, specially power Reactors and central station power Reactors.

Radiation shielding: Radiation Units. Shielding Gamma Rays and Neutrons. Introduction to shield al. culations.

Materials of constructions of Requirements-coolants, radiation damages. Problems regarding safety of personnel and disposal of radioactive waste.

E. E. 620 Electrical Design I

(Sessional) 6th Semester (Elect.) 2

Principles of design of electrical machines. Simple magnetic circuits. Specifications, Design of chokes, transformers, starters and field regulators, Elements of design o rotating machines.

E. E. 700 **Project & Thesis**

7th Semester (Elect) 4

(Sessional)

Study of problems in the field of Electrical Engineering

E. E. 701 **Physical Electronics**

7th Semester (Elect 3

Electronic phenomenon in metals; Statistical electron theory of metals, conductors, Semi-conductor, Insulators, fundamental processes in gases, Electrical discharges i vacuum & in gases, applications.

E. E. 703 Industrial Electronics

7th Semester (Elect.).....3

Gas filled tubes, Photo tubes, their characteristics, Controlled Rectifiers and Electronics power conversion, H. F. Induction and Dielectric heating, Electronic motor Control, Electronic measurements and Instrumentation, Electronic Relay Circuits, Resistance Welding control.

E. E 704 Industrial Electronics

7th Semester (Elect.(.....3

Laboratory

Based on E. E. 703

H/week

E. E. 705 Power Stations

7th Semester (Elect.).....3

Power plant load curves and operating factors, Location of the plant, Economics of generation & transmission of power, Bus systems and plant layout and auxiliaries, Grounding Tariffs.

E. E. 707 Transmission & Distribution of Electrical Power.

7th Semester (Elect.)..... 3

Line constants, General treatment of transmission line, Long and short lines. Tee and Pi, Exact Solutions, Generalised line constants and circle diagrams.

Insulators, mechanical characteristics of transmission line calculation of Sag. Voltage and power factory control, economic considerations, calculation of distributors.

E. E. 709 Electromagnetic Field II

7th Semester (Elect.).....3

Solution to field problems.

(a) Laplace's Equation.

(b) Conformal mapping.

Skin effect and circuit impedance.

Hrs/week

Propagation and Reflection of electromagnetic waves, Ionospheric Propagation, Guided Electromagnetic waves :

Parallel plane wave guide, Co-axial wave guide, Rectangular and cylindrical wave guide characteristics. Wave guide resonators. Wave-g uide excita tions.

Introduction to Antennas and Radiation.

E. E. 710 Electromagnetic Fields II

7th Semester (Elect.).....3

Laboratory

Based on E. E. 709.

E. E. 711 Power Systems: **7th Semester (Elect.).....3**

Symmetrical Components.

Solution of power system Networks for symmetrical and unsymmetrical faults. Sequence Networks and their solution. Sequence Impedances and constants of Mach ines. Transmission line sequence impedances.

E. E. 712 Power Systems

7th Semester (Elect.).....3

Laboratory

Based on E. E. 711.

E. E. 713 Seminar **7th Semester (Elect.).....2**

Topics of current Interest and of Research activities

in Electrical Engineering to be decided by the Board of studies.

E. E. 720 Electrical Design II

7th Semester (Elect.).....2

(Sessional)

Filters, D. C. loaded chokes and output, transformer. Audio frequency voltage amplifiers, power amplifiers, Tone compensation, volume expansion, compression and limiting Radio frequency amplifiers osciliators. Design of power supply from mains and batteries.

E. E. 800 Planning and Project

8th Semester (Elect.)... ..6

(Sessional)

Continuation of E. E. 700

E. E. 801 Semiconductor Electronics

8th Semester (Elect.).....3

Semi-conductors : definition and Scope.

The semi-conductor : diode, its properties and application typical circuits. Tunnel diode, its properties and application active for terminal networks with special emphasis on parameters as used in transistor networks.

The transistor as a control device : different types of transistors, common base, common emitter and common

collector configurations. Graphical Analysis, Image matching, Dependance of parametes on current, temperature etc. Noise in transistor.

The transistor Amplifier : Small signal voltage amplifier, feed back amplifier, Audio frequency power amplifier, Limitation of transistor amplifier, R. F. amplifier.

Transistor oscillator, Use of transistor as a Switching device, other semiconductor devices : Tetrode transistor, photocell, Thermistors varistors, Zenner diode.

Hrs/week

E. E. **803 Electronics III**

8th Semester (Flect.).....3

Modulation :	Fundamentals. Amplitude modulation, phase modulation, single side band. Frequency modulation, AM & FM Transmitters.
Demodulation	AM Detection, Different types of AM detectors, frequency Mixers and converters, Demodulation of f. m. signals, Amplitude limiter, Frequency Discriminator, Ratio detectors, AM and FM receivers.
Computing Circuits :	Difference Amplifiers, Adding circuits, squaring circuits, multiplying circuits,

operational amplifiers & their application to the solution of physical problems, Simple logic circuits, Relaxation-Oscillators, trigger circuits.

Radar & Television: Principle of Radar and Television Engineering.

Hrs/Week

E. E. 804 Electronic III

8th Semester (Elect.) ... 3

Based on E. E. 803.

E. E. 805 Switchgear and Protection

8th Semester (Elect.) 3

Circuit breaker ratings, types of circuit breakers, Arc control, restriking and recovery voltages, Relays and protection relaying. Over-current, directional and impedance relays. Pilot relaying. Low and carrier frequency protection of rotating Machines, Transmission lines, Buses, Transformers and Feeders.

E. E. 806 Switchgear & Protection

8th Semester (Elect.) 3

Laboratory

Based on E. E. 805

Hrs/week

E. E. 807 Acoustics and Illumination Engineering.

8th Semester (Elect) . 3

Acoustics : Definition, Radiation of sound, Microphone and loudspeakers, sound in enclosures, Noise control, hearing, speech, intelligibility, paycho-acoustic criteria.

Illumination : Luminosity function, Illumination system, Units and entities, Measurement of illumination, Geometric Graphs and their application, Illumination from surface and line sources, absorption, reflection and transmission, Electric light sources. Illumination standards. Design of interior and exterior lighting system, light and colour.

E. E. 808 Acoustics & Illumination Engineering

8th Semester (Elect.)... 3

Laboratory

Based on E. E. 807.

E. E. 809 Communication Engineering

8th Semester (Elect,(...3

Telephony : Introduction. Telephone transmitter and receiver, Basic telephone equipment, Side tone and anti-side tone circuits, Basic telephone circuits, Introduction to magneto and C. B. system. Automatic telephone - relays, design considerations. Introduction to step by step system and strowger system, Basic Impulsign circuits, uniselectors, trunking diagrams, Subscriber's line circuit (F-I system and strowger system). Two motion selectors Group selectors and final selectors, (F-I system) detailed study, and functions. 2nd preselector and grading (F-I system) Distortion in telephone line loading of lines, repeadters (A. F.

and R. F.) Block diagram for 3+1 carrier stem.

Wireless telephony: S. S. B ; I. S. B. trnsmission. Simultaneous transmission of a number of signals, reception. Detailed study of S. S. B. transmitters and receivers. High accuracy crystal tattice filters, Introduction to V. H. F and U. H. F. system.

Hrs/Week

E. E. 810 Commnnication Engineering
8th Semester (Elect.).....3

Laboratory

Based on E. E. 809.

E. E. 811 High Voltage Engineering
8th semester (Elect.).....3

High voltage supplies A.C.D.C.& Impulse. Measurement of high voltages, Corona, Lightining phenomenon, Line design based on direct strokes, insulation co-ordination Lightining Arresters, Testing of insulation.

Hrs/week

E. E. 812 High Voltage Engineering
8th Semester (Elect.).....3

Laboratory

Based on E. E 811.

DEPARTMENT OF HUMANITIES

Hum. 101 Language (English) (2) I common.

Words and their ways in English Speech. Definition of scientific terms. Construction of sentences and paragraphs. Amplification and description. precis writing. Essay writing, Commercial correspondance : phrases & idioms.

Hum 301 Civics (3) III Chem. E. & III C. E.

What is Civics--its methods and utility of study. Modern form of government. Merits and demerits of democracy. Organs of government-legislative, executive and judiciary. The, separation of functions. Functions of modern govt. Public opinion. Political parties. Electorate—its extent and nature. Citizenship—its rights and duties. Local government—its categories. Civic ideas. Nationalism. U.N.O. and its agencies.

Hum. 401 Engineering Economics (2) IV Chem. E.,IV C.E III E.E., III M.E. & III Met. E.

Definition and Scope of Economics :—

Its utility and importance to Engineers. The economic activities of men, Fundamental concepts—utility, goods, wealth, value and price.

Consumption :—

Characteristics of wants. The law of diminishing marginal utility. The law of equi-marginal utility. Demand —elasticity of demand, its measurement. Consumers skrplus

Production:—

Factors of production—land, labour, capital and organisation. The laws of returns and their causes. The theory of population. Capital and round about methods of production. Division of labour. Economies of large-scale production. Sovereignty of consumers under capitalism.

Market :—

Localisation of industries. The problem of mobility of resources. Short period and long period markets. The theory of value. The concept of margin and its significance in the analysis of price.

Distribution ;—

Functional vs. personal distribution. The marginal productivity theory.

Hum. 403 Sociology (2) IV C. E. & IV Met. E.

Sociology :—

Its meaning, scope and nature. Evolution of society

Family—its functions. Industrial Revolution and its impact upon the family. Urban and rural communities and their social pattern. Concept of welfare state. System of production and ownership—capitalism, socialism and communism. Nationalisation of industries. Settlement of industrial dispute, arbitration, mediation, conciliation. Trade unionism. Muslim Renaissance in India. Evolution of Pakistan nation and state.

Hum. 601 History of Engineering and Technology, (2) IV E.E.

Prehistoric Era (before 3000 B. C.)

Early stone age, domestication of animals, irrigation canals, reservoirs, copper, wheels, temple construction Mohenzodaro, Harappa, etc.

Ancient Empires (3000-1200 B. C.)

Sumar, Egypt, India. Crete, development of mathematics, alloys, wood, stone, development of surveying-improved irrigation.

Iron Age (1200-600 B. C)

Decline of ancient empires—use of iron-pregreek cultures.

Age of the Greeks (600 -200 B. C.)

Rise of Persian, Pontoon bridge, Canal, Socratis, Plato, Aristotle, Archimedis, Alexander the Great, Slavery, Astrology, medicine, cultural art, public building, harbour, basic mechanics, Astronomy.

Roman Influence (509-476 A. D.)

Road—Aqueducts, water supply, bridges, colosem.

The middle Ages (400-1200 A. D.)

Byzentine Empire, Arabian Scientists, Muslim Empire, Arabian advances in Mathematics paper, textiles, pottery, Chemistry and Medicine.

Begining of Renaissance (1200-1500 A. D.)

Regeneration, military engineering, gunpowder, impact of printing, Holy Roman Empire—disappearance of slavery conditions in India—Pathans, Moghuls.

Renaissance (1500-1750 A. D.)

Davinci, Copernicus, Franois Bacon, Water wheels, Mining, Professional status of Engineers.

Industrial Revolution in England (1750-1830 A. D.)

Steam Engine, Coal, Iron, Factories, Rail roads.

The Colonies in the East (1757-1857)

East India Company—the Railroads, artificial dyes vs. Indigo cultivations : Handloom vs. British Textiles, Permanent Settlement.

Age of Electricity and Steel (1665-1910)

Telephone, Radio, electric lighting, power generation,

internal combustion engines, flying machines—steel bridge constructions—mining and Metallurgy, oil, advances in Physics--Radio activity, X-Rays, E. M. field theories, Relativity.

The age of Mass Production (1910 to present)

Improvement automobiles, world war I-AM/FM, Television, Civil Aviation--hydroelectric power, steam turbine -- plastics--Synthetic materials -- World War II,- Quantemn theory, fundamental particles, Atomic Energy--Automation Space technology.

Engineering and Society.

Effect of Engineering on Economics, Social structure, standard of living values-with special reference to problems and developments in underdeveloped countries :- Population, food, education unemployment. The future.

Hum. 605 Technical Report writing (2) VI C. E., VI Ch. E., IV M. E., & IV Met. E.

Essentials of technical prose. Technical exposition. Organisation of materials and logical presentation of facts. Principles of report writing. Materials of a report. Standard form of a Thesis. Preparation of short speeches and class-room debates.

Hum. 603 Industrial Administration (3) VI C. E.

Modern industrial tendencies ; growth and increase in

size, specialisation, standardisation, division of labour, transfer of skill, scientific management methods in management and organisation.

Formation and maintenance of policies ; analysing the industrial problems.

Principles of organisation—forms of organisation. Committees as controlling mechanism.

Leadership and morale. Human elements in industry. Industrial Relation—methods of selecting employees, terms and conditions of employment, promotions, transfers, wages and rewards of workers, training and educating the workers.

Accidental prevention and safety instructions.

Medical treatment, hospital and nursing services, prevention of industrial deseases, dust control, shop sanitation. ventilation and lighting, and other health requirements.

Recreational and social activities, industrial housing, gardens parks, restaurants, stores and unemployment insurance, and other employees services,

Hum. 701 Industrial law (2) VII M.E. & VII Met. E. & Ch. E.

Contract Law:

What is a contract ? Agreement ; law regarding

offer; revocation of offer, law regarding acceptance, conditions necessary to make an agreement a contract; i.e. an agreement enforceable by law; void, voidable and unenforceable contact; coircion; undue influence mistakes; misrepresentation and fraud; breach of contract; remedies for breach of contract.

Partnership.

Distinction between partnership and co-ownership; partnership and limited company; Relations of partners to one another; relations of partners to third parties; restrictions on the power of the partners; registration: duration of partnership, dissolution of firms, effect of dissolution.

Company Law.

Kinds of companies; formation of company, promotors, memorandum of association, articles of association, registration, prospectus; share capital: different classes of shares, transfer of shares, meeting different types, resolution-different type, borrowing power winding-up.

Hum. 801 Accounting (2)VIII Chem.E., VIII M.E. V C. E, V Met. E. and IV E.E.

Definition of Book-keeping. Objects and Advantages

of Book-keeping. Principles of Double Entry Book-keeping.

The nature of a Transaction. Classification of Accounts. Rules for Debit and Credit.

Transactions on Capital, Drawings, Bad Debts, Discount, Acquisition disposal of property, Improvement on Property, Repairs, Depreciating. kinds of Cheques and Treatment of Cheques in Accounts.

Journal. Cash Book with 'bank' column. Bank Reconciliation Statement Imprest System of Petty Cash.

Ledger : posting, Balancing and Closing.

Trial Balance : Functions. Preparation of Trial Balance. Limitations of Trial Balance.

Final Accounts- Preparation of Statement of profit and Loss, and Statement of Assets and Liabilities. Provisions and Simple Adjustments.

Cost Accounts, Reasons for cost Accounts. ccorded Cost. Estimated cost. Standard Cost. Elements of Cost. Sources of Cost Data: wages Abstract, Job Card, Time Sheet, Bin Card, Stores Requisition Material Abstract. Distribution of overhead charges. Cost Ledger.

DEPARTMENT OF MATHEMATICS

Hrs/Week

Math 101 I Common 3

Differential calculus- Differentiation of parametric and polar equations, application of differential co-efficient in finding the tangent normal, subtangent, subnormal; successive differentiation, maxima, minima, Rolle's theorem, mean value theorem, indeterminate forms, L'Hospital's rule, curve tracing, convergence and divergence of series' series expansion, Taylor's theorem, Maclaurins' theorem, expansion by differentiation and integration,

Conic sections : - Circle ; system of circles, co-axial circles, orthogonal circles ; Equations of parabola, ellipse, hyperbola in cartesian and polar co-ordinates ; Tangent, normal, asymptotes ; director circles.

Math 103 I common. 3

Integral calculus : Integration as a process of summation, difinite integral, area of plane curves in rectangular and polar co-ordinates, volumes of solids of revolution, lengths of curves and surface area of solids of revolution.

Differential equation :—	Formation, equation of first order, Variables separable, homogeneous; First order linear equation ; one variable absent, Glairut's from.

Math. 201 II Common. 3

Differentinal Calculus :—	Hyperbolic functions ; curvature in cartesian, polar and parametric co-ordinates ; circle, centre and radius of curvature : Evolute. Partial differentiations, Geometrical Interpretation, total differential, Euler's theorem of homogeneous function. Taylor's theorem of more than one variable : maxima and minima of functions of more than one variable.
Integral Calculus :—	Reduction formulae, Integration by various methods, Improper integrals, Multiple integrals and its application, Jacobian, Beta function, Gamma function.
Differential equations :—	Exact equations, general linear equations of second and higher orders with constant co-efficients, operator D, homogeneous and linear equations, Equations of first order and of higher degrees.

Hrs/Week

Math. 203 Analytical solid geometry & Matrices-II common 3

Analytical solid geometry :— System of co-ordinates, distance between two points, point dividing in a given ratio, projection, direction cosines, equation of planes, angle between two directed lines, distance from a point to a plane, condition of perpendicularity and parallelism of planes and straight lines, perpendicular distance from a point on a straight line, co-planar lines, shortest distance between two given straight lines, volume of a tetrahedron.

Standard equation of conicoids, sphere ellipsoid, hyperboloid of one sheet, hyperboloid of two sheets, Elliptic paraboloid hyperbolic Paraboloid, cone cylinder, tangent planes normal lines, condition of tangency.

Determinants and matrices :— Expansion of determinants, properties and product of determinants. Definition of matrices, various types of matrices matrices associated with a given matrix, transpose and conjugate transpose, Hermitian and skew-Hermitian matrices, submatrices, determinant of a square matrix, minors of a matrix ; addition

substraction multification, division and partitioning of matrices ; adjoint rank, vector space and inverse ; Caley-Hamilton theorem, distinct roots of a chracteristic equation ; elementary transformation and solution of systems of linear equations.

Hrs/Week.

Math. 301 III common to all Deptts. 3

Differential equations:— Partial differential equation, Particular solution with boundary and initial conditions, wave equations, solution in series Legendres equation, Legendre's polynomial : Bessel's equation and Bessel's function ; Fourier series. Error function.

Laplace's transform :— Introduction, basic theorem, use in the solution of differential equations.

Math. 401—IV C. E. &
Math. 403 Vector Analysis & Complex variables—
IV M. E., Ch. E., E. E., M. E. 3

Vector Analysis :— Addition and multiplication of vectors, easy application to mechanics and

geometry dot and cross products, multiple products, gradient divergence, curl Gauss's theorem, Green's theorem, Stoke's theorem. Successive application of the operator V. Laplace's equation, curvilinear co-ordinates.

Complex Variable :— General functions of a complex variable, the derivatives and the Cauchy-Reimann equations, conformal mapping line integral of a complex function, Cauchy's integral theorem, Cauchy's integral formula, Taylor's series, Laurent's series, Residues, Cauchy's Residue theorem, Singular points, evaluation of residues, contour integration.

Math. 501 V. C. E. 4

Statics :— Stable, unstable quilibrium, 'atenary' forces in three dimension, central axis, wrench.

Spherical Trigonometry and Astronomy :— Sphere, great circle, small circle, spherical triangle, polar triangle, properties of spherical triangles, relations between the sides and angles of a spherical triangle. Properties of right-angled triangle, solution of triangles.

Systems of celestial co-ordinates, Kepler's laws of planetary motion, twilight, harvest moon, eclipses, siderial and solar time, equation of time.

Statistics :— Introduction, Elements of combinatorial analysis, Probability, definition and rules of combination, frequency, distribution—normal, binomial, poison, Modes, median, arithmetic mean, weighted mean, residual, standard deviation, curve fiting correlation, method of least squares.

Hrs/Week

Math 503 V E. E. 3

Statistics :— Same as in Math. 501

Fourier's Analysis and Fourier's integral :- Simple harmonic vibration, Fourier's series, convergence of Fourier's series, Fourier's analysis, Fourier's integral.

Harmonic analysis :— Introduction—Laplaces equation in cartesian, cylindrical and spherical co-ordinates—cylindrical harmonics—con-

ducting cylinder in a uniform field— General – cylindrical harmonics – spherical harmonic—potential of a ring -potential about a spherical surface- general propertise of harmonic functions.

Hrs/Week

Math. 505 V Ch. E. & V M. E. .....

Statics :- Same as in Mathematics 501.

Statistics :- Same as in Mathematics 503.

Fourier's analysis, integral and transform :- Same as in Mathematics 503.

Math. 601 VI Ch. E., VI C. E., VI M. E. .....

Numerical Analysis :-

Interpolation :- Difference table, Newton's formula for forward and back-ward interpolation Lagranges formula with unequal intervals, divided.

Newton's formula for interpolation

	with divided difference, difference. Confluent divided difference. Central difference formula, Gauss's formolae. Stir ling's formula, Bessel's formula. Reverse interpolation : Successive approximation or Iteration, Reversion of series, Subtabulation-
Numerical Differentiation :-	By Newton's forward and Backward formula by Stirling's formula, by Bessel's fotmula and Calculation of errors.
Numerical Integration - --	Trapezoidal rule, Simpson's rule, Weddle's rule, Calculation of errors, relative study of the three rules. Euler-Maclaurin's formula, Euler's Summation formula, Stirling's formula for approximate value of a factorial, Gregory's formula, Central Difference quadrature formula, Newton-Cote's formula, Deducatious from Newton Cote's formula, Gauss's metho ', Legendre's Polynomials,
Numerical Solution of Algebric and transcendental equation :-	Graphical method, Method of False position, Method of Iteration, Method of Iteration for Iteration for simultaneous equations, Newton-Raphson's method, Newton-Raphson's method for simultancous equation, Graeffe's root-squaring method,

Numerical solution of differential equation :-	Picard's method, Runge-Kutta's method, Solution of simultaneous equation by Picard's and Runge-Kutta's method.

Hrs/Week

Math. 602 (Practical) VI Ch. E., VI C. E., VI M. E. 2

Numerical calculation by all the meth[illegible] mentioned in the Theoretical porti[illegible] with the help of a Calculator.

DEPARTMENT OF MECHANICAL ENGINEERING.

M. E. 101 Basic Heat Engineering. 3

Introduction to sources of heat energy and its ut[illegible] sation in heat power plants. Working principles, [illegible] boilers, steam engines, simple steam turbine, gas engin[illegible] petrol engines, diesel engines, air compressors and blo[illegible] ers. Study of important details, mountings and accessor[illegible] of the above and their functions.

Hrs/Week

M. E. 102 Basic Heat Engineering. Laboratory. 3

The practice period will be devoted to the inspection of the above heat engineering equipment, demonstration of their working, and to making sketches.

M. E. 103 Mensuration. 2

Aids to Calculation :— Approximation for products, quotients, squares and square roots, to serve as a check on calculations by logarithm and slide rule. Use of logarithmic tables and slide rules, Investigation for Units. Examples to include engineering formula.

Mensuration : Areas of regular polygons. Areas of irregular quadrilaterals and irregular polygons; length of chord and maximum height of arc ; Area of segment , Area and perimeter of ellipse , Area of a parabolic segment; Surface area and volume of cone, prism, pyramid, frustrum of cone, frustrum of pyramid : zone of sphere and segment of sphere. Rules of Guldinus. Calculation of weights. approximate method of finding area of surface.
Simpon's rule.

M. E. 301 Thermodynamics I. 3
III M. E. & III Met. E.

The system boundary and the working substance Thermodynamic Properties..

First law of thermodynamics, Continuity of mass, Con servation, of energy equation of closed system, steady flow energy equation, Enthalpy, steady flow equation with enthalpy, application of steady flow equation, perpe tual motion of the first kind.

Energy Relations : Specific heats, reversibility, Entropy, energy relations.

The Ideal gas : The Gas constant. Joule's Law, internal energy and enthalpy of an ideal gas, relation between C_p and C_v, enthalpy change of an ideal gas.

Entropy and the second law of Thermodynamics : Thermodynamic temperature, various statemets of second law of thermodynamics, available and unavailable energies, entropy from the Carnot cycle, Clausius Inequality-loss of available energies, entropy from the Carnot cycle, Clausius Inequality-loss of available energy with heat transfer. Second law analysis ; Helmoty-Gibbs function, second law and Probability. Third law of thermodynamics. Perpetual motion of second kind.

Processes of an Ideal Gas : Constant volume, Constant pressure, isothermal adiabatic and isentropic processes. Irreversible adiabatic process with work, poly-tropic process, throttling process.

Cycle Analysis and Reversible and non-reversible Cyc les . Mean effective pressure, ratio of expansion, ratio of compression, pressure ratio Carnot and Erricsion

cycle ; the reversed Carnot cycle with reference to heat pump. Ideal cycles for internal combustion engines : Otto. Diesel, dual-combustion joule and Atkinson.

Steam Generation ; Properties of steam, steam calorimetry , uses of temperature entropy and Molleir diagrams Carnot cycle with steam, Rankine cycle.

Hrs/Week

M. E. 302 Thermodynamics - I 3

Laboratory

III M. E. & III Met. E.

Study and Calibration of instruments for measuring pressure, temperature, speed and power, Calibration of weighing scales and balances. Temperature pressure relation of steam, steam Calorimetry.

M. E. 303 Engineering Mechanics. 3
III M. E.

Friction applications : Axle friction, belt friction, pivot friction, frictional torque for screw with square thread, friction wheels, rolling resistances, Maximum and minimum as related to points of application and directions of forces. Non coplanar forces and couples ; Equillibrium of general force system in space. Centroid, area, moment of inertia, product of inertia, mass moment of inertia.

Displacement, velocity and acceleration curves derivation of one from the other, Force Systems that produce rectilinear and curvilinear motion.

Simple and conical pendulam. Super-elevation of curves. Relative motion, rotation and plane motion of rigid bodies, compound pendulam, centre of percussion. Combined sliding and rolling. Work, energy, power and efficiency. Principle of impulse and momentum linear and angular ; conservation of momentum, impact.

Hrs/Week

M. E. 306 **Machine Drawing.** 3
III M. E.

Scope of Drafting Department in a large manufacturing organisation, its relation with design, process and production. Requirements of working drawings, detail and assembly, dimensioning with tolerances, notes, titles, record strip and part list.

Working drawing of spur, bevel and worm gears. Preparing complete working drawings, detail and assembly from actual machines or machine Sub-assemblies. Preparing assembly drawings from a given set of detail, drawings of some mechanical devices.

M. E. 307 **Heat Engineering** 3
III E. E.

Fundamental concepts of the kinetic theory of gases and

the general energy equation. Elementary thermodynamics of a perfect gas ; properties and laws of perfect gases, simple energy equation, reversible non-flow processes. Thermodynamics. Steam generation ; Properties of steam, steam calorimetry, uses of the temperature entropy diagram. Rating and performance of boilers. Carnot cycle with steam ; Rankine cycle : Theory of steam engines ; hypothetical indicator diagrams ; performance of steam engines. Ideal cycles for internal combustion engines ; Otto : dual-combustion performances of internal combustion engines.

Hrs/Week

M. E. 308 Heat Engineering Laboratory 3

III E. E.

Practical experiments based on M. E. 307

M. E. 309 Theory of Machines. 3

III E. E. & III Chem. E.

Power transmission : Belt, V-Belt, rope and chain drives ; Gear trains-compound, reverted epicyclic ; benel, helical worm and wheel drives.

Friction and Lubrication in bearings-journal and pirot. Balancing of rotating and reciprocation parts, Vibration-Longitudinal, transverse and torsional.

Hrs/Week

M. E. 401 Thermodynamics II 3

IV M. E. & IV Met. E.

Steady and non flow processes of vapour ; Mixture of gases, mixture of steam and air, psychrometric charts.

Kinetic Theory of Gases, Variable specific heats, volumetric heats, entropy equations, heat-entropy diagrams for air and gases—Thermodynamic processes on heat entropy chart.

Solid, liquid and gaseous fuels—properties and tests. Lubricants, properties and tests.

Combustion-Stiochiometry, air equirements, relations of exhaust gas composition to air supply in specified chemical reactions.

First law analysis, internal energy and enthalpy changes in isothermal reactions, non-isothermal reactions e. g. adiabatic combustions. Effects of phase of reactions and phase of products, Enthalpy of functions, Heat of reactions, heat of formations, calorific valve, Bomb and steady flow fuel calorimeters. Second law analysis of chemical reactions, isothermal reactions, entropy change, maximum work obtainable from a reaction, and its relation to the efficiency of internal combustion engines.

Hrs/Week

M. E. 402 Thermodynamics II
Laboratory. 3
IV M E. & IV Met E.

A. S. T. M. tests on solid, liquid and gaseous fuels. Exhaust gas analysis, A. S. T. M. tests on lubricating oils.

M. E. 403 Mechanics of Machinery I 3
IV M. E.

Kinematic chain, mechanism, machines. Introduction to basic mechanism and their inversions.

Velocity diagrams, velocity image, instantaneous centre, body and space centrodes, acceleration diagrams, acceleration image, Kleins, Ritterhau's and Bennet's constructions. Analytical solution for velocity and acceleration of reciprocating mechanisms.

Cams and cam followers, profiles to impart definite motion to the follower taking in to consideration the characteristics of different types of motion.

Power Transmission : Belt, rope, V-belt and chain drives friction clutches, conical and plate, Brakes.

Gear trains, compound, epicylic Bevel. helical, worm and wheel drives.

Hrs/Week

M. E. 405 Fluid Mechanics I 2

IV M. E.

Introduction :— Ideal and real fluid.

Hydrostatics :— Pressure in fluids at rest—relationship between pressure and elevation for any fluid having a given density distribution and for an ideal gas having a given temperature distribution. Magnitude and line of action of the resultant thrust on a plane and on simple curcued surfaces immersed in fluids.

Kinematics of fluids : Definitions of steady and unsteady, laminar and turbulent motion path line, stream line and stream tubes. Use of velocity distribution and mean velocity. Description of motion around stream lined bodies and bluff bodies, boundary layers, brakaways and wakes.

Dynamics of fluids in steady motion: Derivation of the steady flow mass balance (equation of continuity) and of the steady flow momentum balance (Momentum princlple from the conservation of mass and from Newton's second law of motion.)

Derivation of the Euler's equation of motion for stead flow along a

stream tube for a fluid having arbi trary properties. Deduction, by integration or derivation from Newton's second law, of the equation for the frictionless steady flow of a fluid of uniform density under uniform gravity (the total head equation) that is $p/w + V^2/g + z$ is constant along a stream line. Definitions of pressure head, kinetic head, and total head.

Application of the total head equation to orifices, venturimeters pitot and pitot-static tubes.

Use of momentum principle to deter mine forces due to impingement jets on surfaces at rest ; pressure rise across an abrupt increase in section of a pipe, nozzle ; thrust doveloped by jet propulsion of steady moving craft and drag on bodies (using given distribution of velocity and pressure.)

Hrs/Week

M. E. 406 Fluid Mechanics I

Laboratory 3

IV M. E.

Experiments based on M. E. 405

Hrs/Week

M. E. 407 Manufacturing Processes I 3

IV M. E.

Casting : Selection of methods of sand casting. Design of patterns. Coremaking. Die-casting and centrifugal casting. Shell mould plastic mould, metal mould. Precisio investment casting.

Forging and Extrusio : Principal metal working processes-rolling, cold drawing, forging, extrusion Machines and tools.

Stamping and Forming : Metal shearing operation, bending, drawing, stretching, squeezing. Presses and press tools-

Joining : Welding and allied processes—electric arc, thermit, gas, Metal spraying, surfacing, hard facing, brazing and soldering.

Machining Turning operation—lathes and lathe accessories. Turret and capstan lathes.

Drilling and allied operations—drill presses, boring machines, tapping machines and accessories. Shapping and planing and Machine tools Milling operations and milling machines Broaching, sawing and filing machines.

Hrs/Week

M. E. 409 Fluid Engineering 3
IV M. E.

Bernoullis equation—Flow through pipes. stream limed and turbulent flow—pipe friction, Venturimeter Water Hammer.

Flow through channels—wiers & Notches, Pelton wheel, Reaction Turbines, Centrifugal and turbo pumps, reciprocating pumps.

M.E. 410 **Fluid Engineering**
Laboratory 3
IV E. E.

Practical experiments based on M. E. 409

M.E. 501 Applied Thermodynamics I 3
V M. E.

Heat Transfer· Fourier's law for thermal conduction, steady and transient conduction in solids; numerical and graphical method

Convection Heat: Dimensional analysis; surface co-efficient of heat transfer for steam line and turbulent flow of fluids ; logment temperature difference and overall heat trans fer coefficient for heat flow.

Thermal Radiation : Stefan—Boltzman's law for radient heat transfer, radiation between surfaces of solids separated by non-absorbing medium.

Hrs/Week

M. E. 502 Applied Thermodynamics I Laboratory 3

V M E.

Combustion Experiments :

Limits of inflammability in gaseous liquid and solid fuel air mixtures ; flame velocity determination and spec troscopic studies.

Heat transfer and combustion Experimeuts: Experimental determination of thermal conductivities of insulating materials, film co-efficient of heat transfer of vapour; free loss heat, heat transfer coefficient, coefficient of emissivities of different, surfaces, overall heat transfer co-efficient ,

Spray nozzle characteristics for cooling water and fuel injector .

M. E. 503 Mechanics of Machinery II 3

V M. E.

Inertia and kinetic energy of reciprocating parts and

connecting rods, turning moment diagrams. Balancing-static and dynamic, applied to reciprocating and rotat ing parts. Balancing mechines.

Free and forced bibration of simple mechanical systems. Vibration isolation, Vibration multi-mass systems, shafrs, plates and gears, properties of the natural modes. Torsional vibration in reciprocating engines. Whirling of rotors and shafts. Impact vibrations. Self excited vibrations.

Measurements and recording of vibrations. Frequency measurements—Elementary properties of sound. Analysis and reduction of machinery noise.

Governors, spring and gravity controlled, inertia type. Precession and gyroscope acceleration, gyroscopic couples gyroscopic stabilisation—directional control.

Hrs/Week

M. E. 504 Mechanics of Machinery Laboratory 3

V M. E.

Practical experiments based on M. E. 503.

M. E. 505 Fluid Mechanics II 2

V. M. E.

Fluid Friction:

Definition of coefficient of viscosity ; longitudinally uniform steady laminar flow in circular pipes (Poisuelles equation and its derivation) and turbulent flow in pipes and channels with 'f' Definition of loss of head its calculations for uniform pipes using a given value of 'f' Hydraulic gradient. Pipe in parallel and in series. Uniform (Normal depth) flow in open channels of uniform section.

Unsteady Friction :

Quasi-steady analysis, i. e., simplified treatment of time of emptying containers.

Dimensionless Parameters:

Reynold's No. Froude's No. as examples of criteria determining types of flow. Friction factor ; Lift coefficient; drag coefficient skin drag coefficient, discharge coefficient velocity coefficient and their calculations from Reynold's No. the relation thereto being given. Examples including notches, weirs, orifices and flow along flat plates Deduction from Poisuelle's equation of the relation between 'f' and Reynold's No. for laminar flow in a pipe of uniform circular cross-section.

Hrs/Week

M. E. 506 Fluid Mechanics Laboratory 3

V M. E.

Hrs/Week

Experiments based on M. E. 505

M. E. 507 Manufacturing Processes II 3
V M. E.

Mechanism of chip formation and importance of such items as ; tool geometry, physical properties of metal cut, and friction between chip and tool with regard to tool design and performance. Metal cutting dynamometers. Economics of metal cutting, speed, feed.

Screw threads and their manufacture, Gear and gear manufacture Abrasive grindingwheels and machines. Surface finishing operations.

Machine tool requirements. Principles of machine tool design, kinematic consideration power supply and transmission, thermal stability, vibration and machine tool controls. Testing of machine tools.

Application and limitation of current manufacturing processes new developments. Machining of new materials of construction, use of glass ceramic materials.

M. E. 508 Manufacturing Processes II
Practical 3
V M. E.

Practical work based on M. E. 507.

Hrs/Week

M. E. 509 Mechanics of Materials. 3
V. M. E.

Direct stress, shear stress, compound stresses ; shear force and bending moment, bending and shear stress in beams torsion of shafts, deflection of beams, combined bending and twisting ; close-coil spring ; Curved beam, thick cyliners and spheres ; rotating discs and rings ; Deflection by solving the equation of the elastic curve, area-moment theorem, Greens theorem and Mohr's theorem : Columns, restrained beams.

M. E. 601 Applied Thermodynamics II 3
VI M. E.

Steam Generators :	Combustion equipment, furnace design heat release rates, water walls and, smokeless combustion ; boilers, superheaters, economisers and air heaters.
The Gas loop ;	Draft losses – Capacity and specification of fans, chimney heights.
The water loop :	Feed treatment ; steam cendesers ; feed water heaters steam straps, and deaerators
Refrigeration cycles :	Thermodynamic analysis : properties of refregerants, vapour compression and absortion systems.

Hrs/Week

M. E. 602 Applied Thermodynamics II Laboratory 3

VI M. E.

Boiler water analysis : Hardness, alkalinity, dissolved oxygen, and free contents ; value determination of oxygen content and conductivity of condensate.

Boiler heat balance and steam calorimetry.

Pressure temperature relation of vapour other than steam ;

Psychrometric measurements and determination of humidity.

M. E. 603 Design of Machine Elements 3

VI M. E.

The design of machine elements of the basis of static and dynamic working stresses. Selection of materials. Economic problems in design. Calculation and use of various machine elements. Linkages ; fastening ; power-transmission equipment : friction and ludrication.

M. E. 604 Design of Machine Elements Sessional 3

VI M. E.

Practical design and preparation of working drawings based on M. E. 603.

Hrs/Week

M. E. 605 Fluid Mechanics III 2
(VI M. E.)

Aerofoil and its characteristics ; Variation of velocity in the boundary layer on flat plates.

Fluid friction Determination of skin friction drag co-efficient and thickness from the momentum integral. Descriptive knowledge of the boundary layer development at entry to a pipe and velocity profiles. Friction factor for turbulent flow in pipes and its relation to pipe Reynold's No. and relative roughness.

Uniform depth flow in channel and relation to friction factor, Laminar flow between extensive flat plates.

Reciprocating water pump : Acceleration heads. Effect of air vessels in suction and delivery pipes.

Unsteady flow in pipes : Derivation and use of the term, (L/g) U/t in the total head equation for the unsteady flow of a fluid of constant density in a rigid pipe. Pressure rise due to instantaneous and complete stoppage of a compressible liquid in an elastic pipe.

M. E. 606 Fluid Mechanics III
Laboratory 3
VI M. E.

Practical experiments based on M. E. 605

Hrs/Week

M. E. 607 Inspection & Quality Control 3

VI M. E.

Organisation of inspection, kinds of inspection.

Standardisation, scope and techniques for maintaining standards Limits and fits; tolerances. Limit ganging. Standards of length. Comparators, Optical projectors, interferrometers. Measurement of an angles, screw threads. Gear tooth. Flatness. Straightness and alignment tests, surface finish. Testing measuring instruments.

Statistical quality control, control charts, Sampling acceptance procedure.

M. E. 608 Inspection & Quality Control **Laboratory** 3

VI M. E.

Practical work based on M. E. 607

M. E.700 **Project** & thesis 6

VII M. E.

Individual design and/or experimentation project in the field of mechanical engineering will be assigned. A completed thesis on the individual assignment shall be submitted.

Hrs/Week

M. E. 701 Applied Thermodynamics III 3
VII M. E.

Steam Engines efficiencies and performance; steam turbines, impulse and reaction; velocity diagram, work from impulse principle, compounding, efficiencies, condition lines, losses; performance, governing, lubrication and details.

Vapour cycles ; Regenerative feed heatings ; reheat and regeneration ; binary vapour cycles ; tapping.

Reciprocating compressors : multistage compression intercooling performance and control.

M. E. 702 Applied Thermodynamics III
Laboratory. 3
VIII M. E.

Performance tests of steam engines, steam turbines, reciprocating compressors, absorption and vapour compression refregerators, cold storage plants, and air conditioning units.

M. E. 703 Engineering Design and Manufacture. 3
VII M. E.

Design of journal and plane surface bearings ; ball and roller bearings design of gears, design for welded joints,

Comprehensive design of a mechanical device leading to practical methods of its manufacture, integrating functional requirements, proportion of elements and methods of production. Manufacturing drawings and operations sequence sheets are developed for efficient manufacture. Economics of tooling in manufacturing process.

Hrs/Week

M. E. 704 Engineerinng Design and Manufacture.

Practical 3

VII M. E.

Practical design and preparation of working drawings of a small mechanical unit.

Two weeks engagement in the workshop for manufacturing the product as designed.

M. E. 705 Fluid Mechanics IV 3

VII M. E.

Steady one dimensional flow : Thermodynamic relations, Energy euqation in suitable form, Bulk modulus, Presure wave propagation ; Mach No. Pressure at stagnation point; Relation between area and velocity ; Flow between converging and diverging streamlines without energy loss, Flow between converging diverging streamlines with energy loss, Plane shock wave, Pressure rise across normal shock wave.

Rotodynamic machinery: Derivation and use of Momentum principle for the steady flow of an arbitrary fluid through rotor or turbine, pump and fan.

Impact of jets on stationary and moving blades with application. General theory and use of performance characteristics for axial and radial flow turbines pumps fans and Pelton wheel. Specific speeds and their units Unit power unit speed.

Hrs/WeeK

M. E. 706 Fluid Mechanics IV Laboratory 3

Practical experiments based on M. E. 705

M. E. 707 Industrial Management I 2

V E.E., VII Chem. E,, VII M. E., VII Met. E.

Industrial growth in western and eastern countries and factors contributing to the growth. Industries of Pakistan: present and future trends. Five year plans general acquaintance with objectives of the plans. Plant location.

Elements of cost of products and their classification depreciation amortisation and obsolescence : overhead ; fixed, variable and semi-variable distribution and allocation of overheads.

Organisation fundamentals ; organisation structures ; continuous and intermittent manufacturing : organisation charts ; span of control ; line and staff departments : committees ; communication systems, Management and Decission making.

Financial structures ; general objectives and policies ; manufacturing policies, original planning : capital investment, shares, loan and working capital, relation between original planning and production planning and control.

Industriai relations ; labour relations : hiring and training ; supervisory personnel ; job evaluation ; appraisal : wages ; systems, incentives and supplements wage and salary administration.

Industrial psychology ; moral and motivation : working conditions.

Hrs/Week

M. E. 709 Methods of Tool Engineering 3

VII M. E.

Production Design of Products Process Planning. Operation and Instruction sheets.

Methods Design. Standardisation of job conditions, principles pertaining to layout and methods improvement. Principles of motion economy. Motion study, use of flow process charts, multiple activity charts, two handed process charts, movements at workplace, work environment.

Taking time studies, rating methods, work sampling. Use of standard data, development of time formula, Coping with unbalance in manufacturing system.

Principles of selection and design of tools, jihs, fixtures and components ; Dimensioning and tolerances. Methods of locating, clamping and feeding support and body design.

Dies-progressive dies-stock guides, stripper anc plate, blank-development. Strip and stamping devices.

Procedures for designing, selecting and procuring necessary tooling.

Electives VII M. E. :—any one of the following ;—

M. E. 711 (2) Advanced Air Conditioning and refrigeration I

M. E. 713 (2) Theory of Plasticity I

M. E. 715 (2) Automobile Engineering I

M. E. 717 (2) Control Engineering I

M. E. 719 (2) Operation Research I

M. E. 721 (2) Aerodynamics I

M. E. 723 (2) Power Plant Engineering I

Hrs/Week

M. E. 800 Project and Thesis 12

VIII M. E.

Continuation of M. E. 700

M. E. 801 Applied Thermodynamics IV 3

VIII M. E.

I. C. Engines : Combustion phenomena in spark ignition and compression ignition engines-combustion chambers, carburation fuel injection, governing valve timing, Jubrication, cooling supercharging and scavanging. Intake and exhaust systems. Rating of I. C. Engines, and their performance.

Thermodynamic calculation methods for combustion cycles-difference between ideal and actual cycles. I. C. Engine indicators.

Gas Turbines : Gas turbine components, working cycles, performance characteristics cycle arrangements.

Jet and Rocket propulsion.

Hrs/Week

M. E. 802 Applied Thermodynamics Laboratory .....

VIII M. E.

Performance tests of S. I. and C. I. Engines, gasturbines, Rocket engines, Rotary compressors ; cetane and Ocfane rating of Fueles.

M. E. 805 Fluid Mechanics V

VIII M. E.

Centrifugal fans and pumps. Axial flow compressors Dimensionless specific speed.

Streat function. Source and sink. Flow of a perfect fluid around a cylinder.

Application of "Pi" theorem.

M. E. 806 Fluid Mechanics Laboratory 3

Practical experiments based on M. E. 806

M. E. 807 Industrial Management II 2

VI E. E., VII Chem. E., VIII M. E. & VIII Met. E.

Plant layout ; layout of physical facilities ; transportation; storage ; materials handling ; maintenance and repairs.

Hrs/Week

Production Control in continuous and intermittent manufacturing ; supplementary planning ; scheduling : despatching ; assembly line control.

Forecasting ; co-ordination in sales and manufacturing ; manufacturing economics ; cost reduction and cost control.

Purchasing ; procedures ; inventory control and waste elimination ; economic lot.

Sales : Organisation and promotion.

Measure of performance ; measurement and analytical problems of productivity, cost of management and industrial re-organisation.

M. E. 810 Methods and Tool Engg. Practical 3
(VIII M. E.)

Practical experiments based on M. E. 709

Electives VIII M. E. Any one of the following in continuation of the elective taken in the VII Semester.

M. E. 811 (3) Air conditioning and Refrigeration II

M. E. 813 (3) Theory of Plasticity II

M. E. 815 (3) Automobile Engineering II

M. E. 817 (3) Control Engineering II

M. E. 819 (3) Operations Research II

M. E. 821 (3) Aerodynamics II

M. E. 823 (3) Power Plant Engineering II

DEPTT. OF METALLURGICAL ENGINEERING

Hrs/week

Met. E. 301 Metallurgy. 2
III M. E.

A brief study of the manufacture of various cast Irons and steels, the making of importance ferrous and non-ferrous alloys. The defects of metal casting, a study of crystallisation, segregation, blowholes, piping during solidification.

The engineering properties corelated with (I) internal structures (atomic, crystal, micro) and (II) Service environments (Mechanical, thermal, chemical, electrical etc.)

A brief study of the thermal equilibrium diagrams of a metallic system. The phase rule and its application to metallic and alloying systems. Relationship between constitution and properties, deformation grain growth recrystalisation and phase transformation in the solid state.

Met. E. 302 Metallurgy.
Laboratory 2
III M. E.

The laboratory exercises involve microscopic examinations of typical metals and their alloys : preparation of micro-sections, grinding, polishing and etching of the metallic sections. Practical study of photo-micrography.

Practical study of heat treatment furnaces ; drawing of heat ; and cooling curves. The study of forged, annealed and normalised steel specimens.

Practices in hardening, tempering annealing, normalising and case hardening and micro-study of specimens produced. Practices in recognition of different types and alloys of metals by physical and non-destructive tests.

Hrs/Week

Met. E. 303 Fundamental Metallurgy II 3
III Met. E

What is metallurgy—the historical development of metallurgy (in brief, the art and science of metallurgy, the scope of metallurgy) and its importance, metallurgy and engineering.

Metallurgical terms—ore. mineral, flux, gangue, slag, matte, speiss, bullion, spelter, roasting, calcining, smelting etc. Broad principles of extraction and the basis of selection of extractive process for common engineering met als. outline method for the treatment of oxide ores, sulfide ores, carbonate ores, etc, exceptions. The fundamental basis of the relative susceptibility of metallic oxides to the conventional carbon reduction process. Brief idea aobut pig iron cast iron, steel, wrought iron, and the furnace used for their manufacture, The technique of refining metals.

Hrs/Week

Met. E. 305 Geology 2
III Met. E.

Physical geology—A general view of earth. Denudation by weather, rivers, glaciers and sea. Transportation, deposition and consolidation of detenitus. Volcanoes and volcanic products, classification of Rocks—The igneous rocks, the sedimentary rocks, the metamosphic rocks and their sub-divisions. The geological age. The relation of rocks and their ages. Earthquakes, the earth's interior. Mountain and related Land forms, Hydrology—Surface water, Subsurface water, the fountain water, etc,

Met. E. 307 III

1. Some basic facts about the fundamentals of atomic Physics.

2. Study of the origin of metallic structure Factors affecting nucleation grain growth etc.

3. Defn of some crystallographic terms like lattice, unit cell, symmetry etc.

Brief study of the different crystal systems. Study the different types of bonds. Types of atomic arrangement in metals.

4. Study of the generation and properties of x-ray. Different methods of taking x-ray photographs. Method

of calculating the lattice spacing from the x-ray photographs

5. A brief study of the fundamentals of alloying. Some basic facts about the structure of cinary alloys. Substitutional solid solution, order dis-order changes, inter metallic compounds, interstitial solid solution.

6. Basic facts about the deformation of a single crystal as well as a poly crystalline metal.

Deformation by slip, twinning, etc. work hardening and dislocation theory.

7. A brief study of the industrial radiography.

Hrs/Week

Met. E. 401 Manufacturing Metallurgy. 2
IV M. E.

Relationship between casting variables, metal structures and cast metal properties. Consideration of specialised casting processes.

Metallurgical study of processing variables involved in joining materials by welding, brazing and adhesive bonding.

Relationship of structure, composition and properties

of materials to making of useful shapes and devices. Processing for shape change and property control by plastic deformation and fracture. Strength and plasticity in isotropic and anisotropic or textured states. Slip line field and limit analysis—Application to hot and cold working of metals—rolling, drawing, extruding, forging and press working.

Fracture of metals. Material behaviors at high temperatures and strain rates.

Powder metallurgy. Diffusion and plastic deformation.

Hrs/Week

Met. E. 402 Manufacturing Metallurgy Laboratory 3

IV M. E.

Micro study of variable castings. Micro examinations of worked and heat treated metals and thin alloys etc.

Met. E. 403 Fundamental Metallurgy II 2

IV Met. E.

The engineering properties of metals. Ductility, Malleability, tenacity, conductivity, welding, casting etc. Alloys-definition, purpose of alloymaking, non-ferrous alloys of engineering importance – brass, bronze etc. Fabrication of metals rolling, porging, pressing, extrusion etc. Welding,

galvanizing, tinning, solidering, brazing etc. Introduction to corrosions. Pyrometry :—measurement and control of temperature.

Hrs/Week

Met. E. 406 Furnace Drawing 6
IV Met. E.

Drawing of metallurgical furnaces :— Foundry cupola Converter, Tilting furnaces etc.

Met. E. 407 Physical Metallurgy 2
IV Ch. E.

Preparation and uses of different metallic alloys. Iron and steel alloys, brasses, bronzes, bearing metals, type metals, antifriction alloys etc. Carbon and tool steels, bolts, rivets, screws and nails. The methods of casting, the defects of metal castings, a study of crys tallisation, seggregation, blow holes, pipings etc, during solidification. The corrosion of metals and the method of its prevention. Protective coating of one metal over another, galvanising, tinning, and electroplating, The variatton of electrical and magnetic properties in metals with respect to different alloys and impur ities. Iron-Iron Carbide diagram and its application to the heat treat ment of Iron and Steel. A relation between constitution and properties. deformation, recrystallisation and grain growth in the solid state. The shaping of metals by forging, rolling and extruding. An idea of normalising annealing, tempering, Case hardening, quinching of steels and their effects on the microstructure and physical properties.

Hrs/Week

Met. E. 08 Physical Metallurgy Laboratory IV Ch. E. 3

The practical work involves making of different non-ferrous alloys, viz : brass, bronze, solder, bearing metals. etc. The study of microscope and its use in the examination of metals and alloys. The preparation of micro-section, the practice of grinding, polishing and etching of metallic sections. Practical study of heat treatment furnaces, drawing of heating and cooling curves, the making of case carburised steel and their microstudy. The study of worked, annealed and normalised steel specimens.

Met. E. 501 Fuels and combustion I V Met. E. 3

Definition and classification of fuels.

Solid fuels : Wood and charcoal.

Coal : Definition and physical properties of coal, the chemical analysis of coals, presence of mineral constitutents in coals, the origin of coal.

The classification of coals into different tanks. The calorific power of coals : influence of different constitutent upon the heating value of coal relationship between the heating value and the analysis of coals—the higher and lower heating values.

Liquid fuels : Petroleum and its prospects in Pakistan. The distallation products of petroleum ; The composition of petroleum, characterization and blending of fuel oils ; fuel oil specifications. Significance of test on petroleum products. The knocking characteristics of motor fuels. Petroleum products from shale. Gaseous fuels ; Natural and manufactured gaseous fuels Producer Gas. Water Gas, Mond Gas—Their manufacture, composition and calorific values.

Hrs/Week

Met. E. 504 Metallurgical Analysis and Assaying Practical 6
V Met. E.

Determination of Iron copper, lead, zinc, manganeese, tin, nickel, antimony and silver from their ores.

Estimation of copper, lead, tin, zinc and antimony from their alloys.

Met. E. 505 Furnace, Refractories and slags 3
V Met. E.

Classification of furnaces, design, construction, operation, and application of different types of metallurgical and industrial furnace. Acid, basic and neutral refractories. Chemical and physical properties that enable them to resist erosion, high temperature, changes of temperature, and

action of molten metal and slag. Study of expansion, contraction, specific heat, corrosivity, permeability thermal and electrical conductivity of refractories. The preparation of refractory materials and their uses in the manufacture of fire-bricks, crucible, retorts, and for lining furnaces.

Hrs/WeeK

Met. E. 506 Furnace design and Drawings 6
V Met. E.

This includes practical study and testing of refractories, and making sketches of different types of Kilns, ovens and furnaces including open-hearth and electric furnaces

Met. E. 507 Mineral Dressing 3
V Met. E.

Purpose and advantages of separating gang materials from valuable minerals, and one mineral from another: Physical and chemical properties of minerals as applied to ore-dressing. Preliminary breaking, intermediate crushing and final grinding of rocks and minerals. The laws of crushing. Preliminary washing and hand-sorting, sizing by screens, classifying and setting in water, Coarse and concentration by jigs, fine sand-and-slime concentration by gravity concentration by flotation, magnetic, electrostatic pneumatic, centrifugal separation.

Evaluation of ore-dressing results, flow-sheet.

Hrs/Week

Met. E. 509 Foundry Engineering 3
V Met. E.

Iron founding—study of Pig iron. The foundry cupola. Melting of pig iron in cupola and air furnaces. Study of the change in composition after melting. Cast irons and their grading gray iron, whitecast iron, Nodular cast iron, malleable cast iron, High tests and alloy irons.

Moulding pattern—study of wooden and metallic patterns. The shrinkage allowance for various castings. The moulding boxes and their castings. The solidification of castings: The phenomenon of crystallisation, etc. seggregation, shrinkage. Production of chilled and malleable casting, die casting, centrifugal gas ing etc. Moulding sands—their origin, grading properties, selection and uses. The constitution and characteristics of clay-bond sands. Preparation of molding sands. Green sand, dry sand, and loam molding. Foundry sand control and testing.

Met. E. 510 Foundry Engineering I
Practical 3
V Met. E.

Practical study of various constituents comprising sand-molding study of core and core making, making of molds for job-casting, preparation of molding sand for non-ferrous castings, etc.

Hrs/Week

Met. E. 511 Mineralogy 3
V Met. E.

Occurrence and association of minerals, Rock-forming minerals, veins and veinminerals. Gem minerals, Ornamental minerals. The refractories, ore minerals, of Iron, Copper, Zinc, Tin, Alluminium, Antimony etc.

Crystallography—A study of the crystallographic terms crystal notation, and symmetry. Isometric system, Hexagonal system etc. Twin crystals and crystalline aggregates. Physical Mineralogy ; Cleavage, parting, and fracture, Hardness tenacity, specific gravity, properties depending upon light, Electrical and magnetic properties.

Met. E. 601 Fuel & Combustion II 3
VI Met. E.

The fundamental reactions of combustion, calculation of gas volumes, problems relating to the combustion of solid, liquid and gaseous fuels.

Stoichiometric calculations related to different reactions in metallurgical analysis. The carbonization of coals at high and low temperatures, manufacture of coke and recovery of bye-products, pulverized coal and briguettes.

Met. E. 602 Fuels and combustion
Laboratory 3
VI Met. E.

Experiments involving the testing of solid, liquid, and

gaseous fuels, the determination of viscosity, coke-size and available space, the ultimate and proximate analysis of coal.

Hrs/Week

Met. E. 603 Ferrous Metallurgy I 3
VI Met. E.

Production of Pig Iron : Occurrence and distribution of principal ores of iron, their calcining, sintering and pelletizing. The iron blast furnace and its operation, functions of the Cowper stoves, the dust catcher and the Cottrell precipitator, Chemistry of the process, grades of iron produced, charge calculations etc.

Production of wrought iron, Historical development, the pudding process, treatment of the puddle balls, the Aston Byer's Process, structure, physical properties and uses.

The cementation and crucible steel processes, the sheared steels, their strength, properties and uses.

Manufacture of steel :

The Bessemer process-types, equipments and raw materials, operation, chemistry of the process; comparison.

Met. E. 605 Non-ferrous metallurgy I 3
VI Met. E.

Metallurgy of Copper :

The ores of Copper, smelting in reverberatory and

blast furnaces, pyritic smelting, constitution of Copper matte, Bessemerizing copper matte in different types of converters, wet method of extraction, the electrolytic refining of Copper, the effect of impurities in Copper, the service properties of Copper, factors determining the uses of Copper.

The metallurgy of Zinc ores :

Roasting and calcining of zinc ores, distillation of zinc, the refining of Spelter, uses of zinc, the influence of impurities in Zinc. The ores of lead, concentration and sintering of lead ores, the smelting of lead ores, softening of the lead bullion, desilverization of lead, the Pattinson and Parkes' processes, uses of lead, effect of impurities on lead factors determining the uses of lead.

Metallurgy of Aluminium :

The ores of Aluminium, beneficiation of Aluminium ores difficulties in the extraction of Aluminium, the extraction and refining of Aluminium, the service properties, and uses of Aluminium.

The metallurgy of Tin :

Ores of Tin, dressing and the separation of Tin Ores, smelting of Tin ores in the blast and reverberatory furnaces, the refining of Tin, properties and uses.

The metallurgy of antimony :

Ores, the production of metallic Antimony the reverberatory and the blast furnace smelting. the refining of antimony, properties and uses.

Hrs/Week

Met. E. 607 Metallurgical Calculations 3
VI Met. E.

The charge balance of Cupola, blast and steel furnaces. The heat balance : items of heat supply, items of heat distribution – the Iron blast furnace, the cupola furnace, gas producers, openhearth, conveter etc.

Alloys—heat of fusion of alloys, atomic percentage, calculation of Metallographic constituents.

The law of mass action and chemical equillibrium in metallurgical reactions. Drying, calcining, roasting and sintering.

Copper smelting and converting. Electrolytic processes.

Metallurgy of aluminium and magnesium. Volatilization of metals in melting. Metallurgy of lead.

Heat transfer : calculation of heat flow by conduction, convection and radiation.

Met. E. 608 Metallurgical calculations.
Practical 6
VI Met. E.

To obtain heat and charge balance for a cupola, blast furnace or Bessemer converter from reasonable data ....

Crushing and grinding of ores and preparation of sieve analysis report. The roasting of particular ores and effect of temperature on the nature of products. Any other problem of interest that may be arranged.

Hrs/Week

Met. E. 610 Foundry Engineering 3
Practical VI Met. E.

Making of steel coastings and their alloys. Preparation of brass, bronze, typemetal, etc. Micro-study of various castings and their solidification and crystallization.

Met. E. 611 Physical Metallurgy I 3
VI Met. E.

The states of aggregation, mental vapour and liquid metals, the solid state, space lattices and crystal systems, some general properties of crystals : anisotropy and polymorphy.

Solidification of castings : The form of grains that grow in a liquid, grain size significance of planes in the crystal lattice.

The physical properties of metal : crystal energy, density and thermal expansion, melting point, electrical conductivity etc.

The deformation of metals : elastic and plastic deformations, deformation by slip, deformation by twinning.

Preferred orientation and its consequences.

Changes in properties accompanying plastic deformation, machanism of slip and work hardening. Instability of the deformed state, recrystallization and graingrowth, factors in recrystallization.

Creep and fatigue : the elastic after-effects and strain-aging.

Hrs/Week

Met. E. 700 Projects and Thesis 6

VII Met. E.

1. Design and layout of one of the following :

(a) a modern iron foundry with sand processing plant.

(b) a modern steel foundry.

(c) a re-rolling mill including power supply and soaking furnace.

(d) an electroplating shop having provisions for Nickel, Chronomium and gold plating.

(e) The wastage of Iron and steel, in East Pakistan by atmospheric corrosion and suggest the practical preventive methods with experimental data.

(f) The composition and heat-treatment procedure of a given machine part with experimental data.

(g) Investigation on some problems or current topic in the field of Metallurgical Engineering pertaining to the problems of Pakistan.

Hrs/Week

Met. E. 701 Metal Technology I 3
VII Met. E.

Shaping of metals : forging, Swaging, upsetting, etc. by Blacksmith, coining, embossing, stamping, etc. by mannual process.

Hot working of metals and alloys-Rolling. Forging—pressure, hammer, drop etc. Pipe-Welding—butt, lap etc.

Piercing :—Drawing, spinning, extruding, etc.

Met. E. 703 Ferrous Metallurgy II 3
VII Met. E.

Manufacture of steel ; The open-hearth process, types of open-hearth practices, the charge, operation and chemistry of the processes. comparison. The duplex steel making process, its status with respect to the open-hearth process.

The electric steel making processes ; The induction steel making process, the arc process, superiority of the electric processes over other conventional processes. The other developments including L. D. and HYL process.

Production of alloys in the electric proeesses.

The steel in ingot, killed, semi-killed, and rimming steels, the defects in steel castings and their possible remedies.

Hrs/Week

Met. E. 705 Non-ferrous Metallurgy II 3
VII Met. E.

The metallurgy of Nickel : the ores of Nickel treatment of the silicate ores, the orford process for the extraction of Nickel, purification of crude Nickel the electrolytic process and the Mond process, properties and uses of Nickel. The metallurgy of Chromium-ores, its extraction, uses, properties and ferroalloys.

The metallurgy of Magnesium : Ores of magnesium, the production of magnesium by different methods ; production of magnesium chlorides from brine, from sea-water, and by other processes, the electrolysis of magnesium chlorides, the carbothermic process, the refining of magnesium, properties and uses.

Manganese : Ores of manganese, concentration of manganese ores, production of manganese—the roasting and purification of the ore, electrolysis, properties and uses

of manganese. Production of spiegeleisen and ferromanganese.

Other metalals : Extraction, properties and uses of Cadmium, bismuth, arsenic, cobalt and mercury.

Production of the ferro-alloys : Extraction of chromium, vanadium, tungsten, molybdenum, etc. and their ferro-alloys.

Hrs/Week

Met. E. 708 Metallurgical Analysis and assaying Practical 6
VII Met. E-

The determination of Silicon, Phosphorus, Sulphur, Chromium, Vanadium, manganese, Tungsten, Nickel, Molybdenum and Cobalt in ferrous alloys.

Met. E. 710 Metallography and heat-treatment Practical 3
VII Met. E.

Study of metallurgical microscope, Selection and preparation of micro-sections. Systemetic examination of microstructure of metals and alloys. Practical study of Photomicrography.

Met. E. 711 Physical Metallurgy II 3
VII Met. E.

Definition and importance of alloys, superiority of alloys over pure metals.

Metalloids : The solidus and the liquidus lines, variation of the solidus and the liquidus temperatures with composition, relation of structnre with composition.

Constitutional diagrams—The binary alloy systems : the eutectic reaction, common metals showing eutectic reaction, solidification of eutectic alloys.

Solid Solutions—Partial and complete miscibility in the solid state, non-equillibrium solidification and cored crystals.

The peritectic reaction, limiting cases of the peritectic reaction.

The monotectic reaction : Monotectic decomposition, hypomonotectic and hypermonotectic alloys.

The syntectic reaction.

Complex binary phase diagrams—including the iron-iron carbide, the copper-Zinc and the coppertin systems.

Ternary alloy systems—The Gibb's triangle, tie lines, the space diagram, isothermal sections, vertical sections.

The phase rule and its application to metallic systems.

The heat treatment of metals and alloys : defination and purposes of heat treatment. The heat-treatment of steel-Critical temperature on bearing and coaling, trans-

formation on cooling, austenite transformation at constant temperature, austenite transformation on constant cooling. Effect of grain sill on rate of transformation. hardening by quencing, interrupted quench, tempering austempering, annealing, normalizing, factors in heat-treatment, flame-hardening, induction hardening. The surface-hardening of steels—Carburizing. Nitroding and cyanding their chemistry and operational details. Text Book :

1. Principles of Physical Metallurgy—Doan 2. Phase diagrams in Metallurgy—Rhines.

	Hrs/Week
Met. E. 800 Project & Thesis VIII Met. E.	9

Continuation of Met. E. 700

Met. E. 801 Metal Technology II VIII Met.E.	3

Cold working of metals and olloys :—

Rolling : tubes, wire, metal spining, stetch forming etc. Drawing. coining, cold rolling, Sizing, Swaging, thread rolling, upsetting.

Bending ; angle bending, roll forming, curbing seaming Shearing : punching, trimming, notching, slitting, lancing etc.

Extruding : cold and impact, shot peening, hobbing.

Welding of metals : Farge-welding, Resistance-welding, Gas-welding, Arc-welding, Thermet-welding and Induction-welding.

Hrs/week

Met. E. 803 Ferrous Metallurgy III 3

VIII Met. E.

Limitations of plain carbon steels and the advantages of alloy Steels. The influence of different alloying elements in steel--the effects of adding chromium, Nickel, Manganeese, Tungsten Vanadium, Molybdenum, Cobalt and Silicon. Low alloy steels and high alloy steels, their properties and uses. The plain carbon and water hardening tool steels, alloy cold work tool steels, Shock resisting tool steels; high speed tool steels, hot work tools steels.

The austinitic steels :- high Nickel and high Manganeese steels, Corrosion and heat resisting steels.

Uses, physical properties and heat-treatment of alloy steels.

Met. E. 805 Non-ferrous metallurgy III 3

VIII Met. E.

The metallurgy of gold : Sources of gold, extraction of gold from its ores, the amalgamation and the chlori nation processes. The cyanide process of gold extrac-

tion--chemistry of the process, preparation of ore, sand leaching of gold ores, continuous counter-current decantation process, melting and refining of the gold bullion. Silver : Ores of silver, different processes for the extraction of silver, refining of the silver bullion : The thum and Moebius cells, regeneration of cyanide solutions.

Recovery of metals of the platinum group : From anode slimes of copper cells, from lead baths, from nickel cells, and from gold and silver slimes.

The non-ferrous alloys: Definition of alloys, necessity and utility of alloys.

The brasses : the bronzes the modified brasses and bronzes.

The aluminium alloys: importance of aluminium alloys : the copper-aluminium alloys, the aluminum-silicon alloys, the aluminium-mangascium alloys, the wrought alloys of aluminium and magnesium : the duralumins, the Y-alloys, and the R-R alloys. The copper-nickel alloys, the monels, the coinage alloys, the constantant, the Eureka, Nimonic alloys etc.

The lead-antimony alloys ; type metals, bearing and unit-friction alloys, requirements for a good bearing alloys, the copper-lead-tin-antimony bearing alloys.

The soldering and brazing alloys

Hrs/Week

Met. E. 810 Metallography and Heat-treatment

Practical 6

VIII Met. E.

The cooling curves—the effect of rate of cooling, Annealing, normalising, quenching and tempering of metals and their alloys. Case-hardening :—Carburishing, nitriding, Flame-hardening, age-hardening and Cyaniding.

Met. E. 812 Seminar

VIII Met. E.

Discussion on modern developments and problems of interests in the field of metallurgy.

DEPARTMENT OF PHYSICS

Hrs/Week

Ph. 101 I Common. 3

Heat : Kinetic theory of gases, properties of gases. Radiant energy. Measurement of high temperature.

Light : Defects of images formed by mirrors and lenses and methods of their rectification. Detailed study of eye-pieces and objectives.

Sound: Wave motion, Doppler's principle. Reflection, refraction, absorption and diffraction of sound. Sound insulation in building, Decibel and other units. Musical scale.

Ph. 102 I Common Laboratory 3

(Experiments on verification and illustration of some of the theories covered in Ph. 101)

Ph. 201 II Common. 3

Light : Wave theory of light. Interference, diffraction and polarisation.

Heat : Second law of thermodynamics. Carnot's cycle, Entropy (Physical concept) Joule-Thompson effect. Principle of low temperature production.

Modern Physics : Atomic structure. Bohr's model of hydrogen atom Atomic spectra. Radioactivity. Mass-Energy relation. Binding energy, Fission and fusion processes Laws of gravity—Escape velocity.

Hrs/Week

Ph. 202 II Common Laboratory 3

Experiment on verification and illustration of some of the theories covered in Ph. 201.

Ph. 301 VI M. E. ...

E. M. Theory : Displacement current. Maxwell's field equations. Poynting vector, solution for Plane wave, energy of e. m. field, reflection, refraction, polarisation, metallic reflection, interference, dispersion, scatering, optical activity, radiation from an accelerated charge, radiation from a dipole antenna, laser.

Ph. 601 III M. E. ...3

Modern physics: Thompson and Rutherford atom models, Rutherford's theory of scattering

of particles by a Coulomb field, Bohr atom model, Sommerfield an vec'or atom models; optical X-Ray, radio-frequency and infra-red spectra, Pauli exclusion principle and periodic table,

Quantum theory of radiation, application to photoelectric effect, Compton effect, matter Waves, De Broge wave length, particle velocity and group velocity, experimental verification of matter waves, electron diffraction, electron microecope.

CURRICULA FOR M. Sc. ENGINEERING (CIVIL)

Note :—Every student will select to pursue one of the following groups of subjects as the major group. He will be required to successfully complete courses of at least 24 units in addition to a thesis. Of the 24 units, not less than 16 and not more than 18 units shall have to be from the group of his choice and the thesis shall be from this group. The remaining units shall be chosen from the other group or groups and Mathematics and the subjects therein shall be decided by the student's supervisor in consultation with the Head of the Department.

Hrs/Week

GROUP I

CE 1101.	Advanced Strength of Materials	...(3)
CE 1102.	Theory of Plates	...(3)
CE 1103.	Advanced Structural Design	...(3)
CE 1104.	Numerical Analysis	...(3)
CE 1105.	Reinforced Concrete Structures	..(3)
CE 1106.	Concrete Mix Design Quality Control	...(3)
CE 1107.	Prestressed Concrete	...(3)
	Thesis	

Hrs/Week

CE 1108	Experimental Structural & Stress Analysis	...(3)
CE 1109	Dynamics of Structures	...(3)
CE 1110	Theory of Elasticity	...(3)
CE 1111	Theory of plasticity	...(3)
CE 1112	Theory of Elastic Stability	...(3)
CE 1113	Concrete Construction Practice	...(3)
CE 1114	Shell-roof Design	...(3)
	Thesis.	

GROUP II

CE 1115	Environmental Sanitation	...(3)
CE 1116	Sewage Treatment and stream Sanitation	...(3)
CE 1117	Bacteriology	...(3)
CE 1118	Water Quality and Treatment	...(3)
CE 1119	Ground Water Rydrology	...(3)
CE 1120	Sanitary Design	...(3)
	Thesis.	

		Hrs/Week
CE 1121	Public Health and local Governments	...(3)
CE 1122	Sanitary Laboratory	...(3)
CE 1123	Statistics	...(3)
CE 1124	Statistical Epidemiology	...(3)
CE 1125	Industrial Wastes	...(3)
CE 1126	Introductory Entermology	...(3)
CE 1127	Problem Courses	...(3)
	Thesis.	

GROUP III

CE 1128	Fluid Mechanics	...(3)
CE 1129	Open Channel Flow	...(3)
CE 1130	Design and Construction of dame	...(2)
CE 1131	Advanced Hydrology	...(2+3)
CE 1132	Hydraulic Structures	...(3)
CE 1133	Advanced Fluid Mechanics	...(3)
	Thesis.	

		Hrs/Week
CE 1134	Fluid Mechanics	...(3)
CE 1135	Water Power Engineering	...(3)
CE 1136	Design and Construction of dames	...(2)
CE 1137	Ground water hydrology	...(3)
CE 1138	Sedimentation	...(3)
CE 1139	Hydraulic structures	...(3)
CE 1140	Advanced fluid mechanics	.. (3)
	Thesis.	

GROUP IV

CE 1141	Structural Design of Flexible payment	...(3)
CE 1142	Geometric Design of Highway	...(3)
CE 1143	Bituminous Materials and Mix Design	...(3)
CE 1144	Traffic Engineering	...(3-3)
CE 1145	Soil Mechanics I	...(3)
CE 1146	Measurement of soil Properties	...(3)
CE 1147	Earth Pressures & Retaining Structures	...(3)
	Thesis.	

Hrs/Week

CE 1148	Structural Design of Rigid Pavement	...(3)
CE 1149	City Street Design	...(2)
CE 1150	Airfield Planning and Design	...(2)
CE 1151	Transportation in City Planning	...(2)
CE 1152	Soil Mechanics II	...(3)
CE 1153	Foundation Engineering	...(3)
	Thesis	

Mathematics—

Advanced Mathematics	I
Advanced Mathematics	II

CURRICULA FOR M. Sc. ENGINEERING (ELECTRICAL)

1st Semester.

		Hrs/Week
EE. 1100	Research	16
EE. 1101	Energy Conversion	3
EE. 1102	Control Systems and Servomechanisms (including sessional work)	6
EE. 1103	Engineering Analysis	3
*EE 1104	Power Systems II (including sessional work)	6
	OR	
EE 1105	Electromagnetic Fields III (including sessional work).	6

2nd Semester.

EE. 1200	Research and Thesis (continuation of Research EE. 1100)	20
*EE. 1201	Science of Materials (including sessional work)	6
	OR	
EE. 1202	Advanced Electronics (including sessional work)	6
EE. 1203	Seminar	2
*EE. 1204	Power Systems III	3
	OR	
EE. 1205	Microwaves	3

*Offered at the discretion of the Head of the Electrical Engineering Department.

CURRICULA FOR M. Sc. ENGINEERING (MECHANICAL)

The courses of studies for the award of the Degree of M. Sc. (Engg) in Mechanical Engineering in each part are the following. (The subjects in each semester as and when offered by the Deptt.)

First Semester.

COMPULSORY

		Hrs/Week	Marks
Math. 1101	Applied Mathematics I	40	100
	Any three subjects of the following :		
M.E. 1101	Advanced Thermodynamics I	40	100
M.E. 1102	Advanced Fluid Mechanics I	40	100
M.E. 1103	Advanced Strength of Materials.	40	100
M.E. 1104	Engineering Analysis	40	100
M.E. 1105	Engineering Management	40	100
M.E. 1106	Advanced Engineering Dynamics	40	100
	Total—	160	400

Thesis on Research/Dissertation

Second Semester.

COMPULSORY

	Pre-requisite.	Hrs/Week	Marks
Math. 1201	Applied Mathematics II (Math. 901)	40	100
Any three subjects of the following :			
M. E. 1201	Advanced Thermodynamics II (M. E. 1101)	40	100
M. E. 1202	Advanced Fluid Mechanics II (M. E. 1102)	40	100
M. E. 1203	Theory of elasticity (M. E. 1103)	40	100
M. E. 1204	Mechanical Vibration	40	100
M. E. 1205	Experimental Stress analysis	40	100
M. E. 1206	Heat and Mass transfer (M. E. 1101 and M. E. 1102)	40	100
M. E. 1207	Combustion Process (M.E. 1101)	40	100
M. E. 1208	Production process	40	100
M. E. 1209	Advanced Metallurgy	40	100
M. E. 1210	Turbo Machinery (M. E. 1102)	40	100
M. E. 1211	Theory of Plasticity	40	100
	Total	160	400

Thesis on Research/Dissertation.....

CURRICULUM FOR M. Sc. ENGINEERING
(CHEMICAL)

First Semester

Any four of the following courses as and when offered by the Department.

Course.	Hrs/Semester.	Marks
Ch. E. 1101 Transport Phenomena	42	100
Ch. E. 1102 Advanced thermodynamics	42	100
Ch. E. 1103 Chemical Engineering Kinetics	42	100
Ch. E. 1104 Heat Transfer	42	100
Ch. E. 1105 Mass Transfer I	42	100
Math. 1101 (a) Mathematics I	42	100
	168	400

Research.

Second Semester

Any three of the following courses as and when offered by the Department.

Course.	Hrs /Semester.	Marks
Ch. E. 1201 Electro-Chemical Engineering and Corrosion Science	42	100
Ch. E. 1202 Process Control and Instrumentation	42	100
Ch. E. 1203 Advanced Plant Design	42	100
Ch. E. 1204 Fuel Science	42	100
Ch. E. 1205 Mass Transfer II	42	100
Math. 1201(a) Mathematics II	42	100
	126	300

Research.

DEPARTMENT OF ELECTRICAL ENGINEERING
GRADUATE COURSES.

Hrs/Week

E. E. 1100 RESEARCH

Investigation of some Electrical Engineering problem. 16

E. E. 1101 ENERGY CONVERSION 3

Introduction to theory of direct electrical energy conversion—Thermoelectric and thermionic conversion, fuel cells and photovoltaic conversion, Electromechanical energy conversion, Electronic and thermal conduction processess, Magnetohydrodynamic energy conversion, Characteristics including efficiency, Power density and terminal properties.

E. E. 1102 CONTROL SYSTEMS & SERVOMECH.

ANISMS (including Sessional work) 6

Linear feedback system—dynamic system, Stability, Graphical methods, Nyquist diagram, Bode plot and root locus. Compensation with passive networks, Control system components—Elementary concepts of non linear systems.

E. E. 1103 ENGINEERING ANALYSIS 3

Professional methods of dealing with problems,

Hrs/Week

Mathematical & Physical principles applied to problems of diverse topics in Electrical Engineering, Simulation techniques, Statistical methods.

E. E. 1104 POWER SYSTEMS II
(including sessional work) 6

The stability problem of power systems. Distinction between steady state and Transient Stability. Stability limits and criteria—Transient stability : the Swing Equation and its solution. Two machine and multimachine problems. Typical stability studies and methods of improving stability.

E. E. 1105 ELECTROMAGNETTC FIELDS III
(including sesssional work) 6

Reflection and refraction of electro-magnetic waves from different surfaces ; Radiation and propagation of Electromagnetic waves in isotropic and anisotroic media including ferrites. Different types of antennas : Theory and design.

E. E. 1200 RESEARCH & THESIS
Continuation of E.E. 1100 0

E. E. 1201 SCIENCE OF MATERIALS.
(including sessional work) 6

Introduction to the physical basis of conduction of

Hrs/Week

electricity, dielectric and magnetic properties. Molecular and atomic polarization, metallic conduction, band theory semi-conductors, physical processes in transistors, magnetic materials.

E.E. 1202 ADVANCED ELECTRONICS, (including sessional work) 6

Timing and scaler circuits, triggercircuits : Non-sinusoidal Oscillators, wave shaping and pulsing circuits function generators, noise problems in electronic circuits and transistor circuits. Electronic circuits for instrumentation and computation.

E.E. 1203 SEMINAR. 2

Discussion of the research problem and other advanced topics for guidance of the students.

E.E. 1204 POWER SYSTEMS III 3

Advanced topics in power systems : Grounding of power system Neutrals, Co-ordination of power and communication systems—The influence of swinging and out of step operation upon protective relays. Rapid reclosing circuit breakers.

The Economics of Inter-connected power systems.

E. E. 1205 MICROWAVES.

Wave guides and Cavity resonators : Principles of microwave circuits : generation and measurement of power at microwave frequencies, Maser theory.

B. ARCHITECTURE CURRICULA.

Subjects required of Civil Engineering graduates for B. Arch. degree (5 years)

FIRST YEAR

Semester 1

Subject	hours lec/lab.	full marks
Arch. 101 Basic Design	(0-9)	300
Arch. III Architectural graphics	(0-6)	200
		500

Semester 2

Subject	hours lec./lab.	full marks
Arch. 102 Basic Design	(0-9)	300
Arch. 112 Architectural Graphics	(o-6)	200
		500

SECOND YEAR

Semester 3

Subject	hours lec./lab.	full marks
Arch. 221 Design II	(o-12)	400
Arch. 201 Graphic Art	(o-6)	200
Arch. 241 Art & Civilization	(2-o)	200
		800

Semester 4

Subject	hours lec/lab	full marks
Arch. 222 Design II	(0-12)	400
Arch. Graphic Art	(0-6)	200
Arch. 262 Basic Planning	(2-0)	200
		800

THIRD YEAR

Semester 5

Subject	hours lec/lab.	full marks
Arch. 321 Design III	(0-15)	500
Arch. 403 Sculpture	(0-3)	100
Arch. 341 or 441 History of Architecture	(3-0)	300
Arch. 335 Finish Material	(2-0)	200
		1100

Semester 6

Subject	hours lec/lab	full marks
Arch. 322 Design III	(0-15)	500
Arch. 306 Art & Music Appreciation	(1-0)	100
Arch. 342 or 442 History of Architecture	(3-0)	300
Arch. 316 working Drawings	(0-5)	100
Hum. 314 Psychology	(2-0)	200
		1200

FOURTH YEAR

Semester 7

Subject	hours lec/lab	full marks
Arch. 421 Design IV	(0-15)	500
Arch. 441 or 341 History of Architecture	(3-0)	300
Arch. 415 Details & Specifications	(2-0)	100
Arch. 461 Physical Planning	(2-3)	300
		1200

Semester 8

Subject	hours lec/lab	full marks
Arch. 422 Design IV	(0-15)	500
Arch. 442 or 342 History of Architecture	(3-0)	300
Arch. 464 Landscape Design	(1-3)	200
		1000

FIFTH YEAR

Semester 9

Subject	hours lec/lab	full marks
Arch. 521 Design V	(0-21)	700
Arch 507 Graphic Reproduction	(1-3)	200
Hum. 511 Philosophy	(2-0)	200
		1100

Semester 10

Subject	hours lec/lab	full marks
Arch. 522 Design V	(0-21)	700
Arch. 502 Art-Expression	(0-3)	100
Arch. 572 Professional Practice	(2-0)	200
		1000

UNDER GRADUATE CURRICULA
(B. Architecture)

FIRST YEAR

Semester 1

Subject	hours lec. ses.	full marks
Arch. 101 Basic Design	(0-9)	300
Arch. 111 Architectural Graphics	(0-6)	200
Hum. 101 English Composition	(2-0)	200
Hum. 103 English Literature	(3-0)	300
Hum. 123 world History	(3-0)	300
Math. 101 Calculus etc.	(3-0)	300
M. E. 101 Carpentry and Metal	(0-3)	100
29	(11-18)	1700

Semester 2

Subject	hours lec. ses.	full marks
Arch. 102 Basic Design	(0-9)	300
Arch. 112 Architectural Graphics	(0-6)	200
Hum. 106 a Bengali Literature, or		
Hum. 106 b Urdu Literature, or		
Hum. 106 c English Literature	(3-0)	300
Hum. 112 Logic	(3-0)	300
Hum. 124 World History	(3-0)	300
Math. 112 Statics (Mechanics)	(2-0)	200
M. E. 102 Carpentry and Metal	(0-3)	100
29	(11-18)	1700

SECOND YEAR

Semester 3

Subject	hours lec. ses.	full marks
Arch. 201 Graphic Art	(o-6)	200
Arch. 221 Design II	(o-12)	400
Arch. 241 Art and Civilization	(2-o)	200
Arch. 265 Climatology	(2-o)	200
Hum. 261 Geography	(2-o)	200
Physics 201	(3-3)	400
3o	(9-21)	1600

Semester 4

Subject	hours lec. ses.	full marks
Arch. 2o2 Graphic Art	(o-6)	2oo
Arch. 222 Design II	(o-12)	4oo
Arch. 232 Building Materials	(1-3)	2oo
Arch. 262 Basic Planning	(2-o)	2oo
Physics 2o2	(3-3)	4oo
3o	(6-24)	1 oo

THIRD year:

Semester 5

Subjeet	hours lec, ses.	full marks
Arch. 3o3 Sculpture	(0-3)	1oo
Arch. 321 Design III	(0-15)	500
Arch. 335 Finish Materials	(2-o)	2oo
Arch. 341 History of Architecture	(3-o)	3oo
Hum. 325 Sociology	(2-o)	2oo
C.E. 351 Structures III	(3-o)	3oo
C.E. 311 Surveying	(o-3)	1oo
31	(1o-21)	17oo

during vacation: Arch. 37o
Experience; 6 Weeks

Semester 6

Subject	hours lec. ses-	full marks
Arch. 3o6 Art & Music Appreciation	(l-o)	1oo
Arch. 316 Working Drawings	(o-3)	1oo
Arch. 322 Design III	(o-15)	5oo
Arch. 342 History of Architecture	(3-o)	3oo
Hum. 314 Psychology	(2-o)	2oo
Hum. 322 Government	(2-o)	2oo
C.E. 352 Structures III	(3-o)	3oo
	(11-18)	17oo
	29	

FOURTH YEAR

Semester 7

Subject	hours lec/ses	full marks
Arch. 415 Details & Specifications	(1-0)	100
Arch. 421 Design IV	(0-15)	500
Arch. 441 History of Architecture	(3-0)	300
Arch. 461 Physical Planning	(2-3)	300
M. E.. 401 Mechanical and Electrical for buildings	(2-0)	200
C. E. 451 Structures VI	(2-3)	300
31	(10-21)	1700

during vacation :
Arch. 470
Experience : 6 weeks

Semester 8

Subject	hours lec/ses	full marks
Arch. 422 Design IV	(0-15)	500
Arch. 442 History of Architecture	(3-0)	300
Arch. 464 Landscape Design	(1-3)	200
M. E. 402 Mechanical and Electrical for Buildings	(2-0)	200
C. E. 452 Structures IV	(2-3)	300
C. E. 438 Cost Estimating	(1-0)	100
30	(9-21)	1600

FIFTH YEAR

Semester 9

Subject	hours lec/ses	full marks
Arch 507 Graphic Reproduction	(1-3)	200
Arch. 521 Design V	(0-21)	700
Hum. 511 Philosophy	(2-0)	200
Hum. 531 Economics	(2-0)	200
C. E. 551 Structures V	(2-0)	200
31	(7-24)	1500

during Fifth year Architetural Tour of Pakistan area.

Semester 10

Subject	hours lec/ses	full marks
Arch. 502 Art Expression	(0-3)	100
Arch. 522 Design V	(0-21)	700
Arch. 572 Professional Practice	(2-0)	200
Hum. 514 Speaking	(1-0)	100
Hum. 534 Accounting	(2-0)	200
C. E. 552 Structures V	(2-0)	200
31	(7-24)	1500

DETAILED SYLLABUSES OF BACHELOR OF ARCHITECTURE

I. ARCHITECTURE SUBJECTS

Arch. 1o1 Basic Design (0-9) 300

Analysis and application of the principles of Design. Exercises in freehand drawing in various media. 2 & 3-dimensional studies to develop Design concepts.

Arch. 102 Basic Design (0-9) 300

Extension of Arch. 101. Further study and application of principles of Design with emphasis on proper use of materials in the basic order of space. pre-req: Arch. 1o1

Arch. 111 Architectural Graphics (0-6) 200

Relationship of mechanical and freehand drawing. Study of scale, composition, drafting, lettering, in the execution of mechanical perspectives.

Arch. 112 Architectural Graphics (0-6) 200

Extension of Arch. 111. shadows and reflections in perspective, both mechanical and freehand. pre-req ; Arch.111.

Arch. 201 Graphic Art (0-6) 200

Drawing and painting. Application of various media with Basic Design principles to studies in Art. pre-req: arch: 102 Arch 112.

Arch. 202 Graphic Art (o-6(200

Extension of Arch. 201 various media. Relationship to Architectural presentation. pre-req: Arch. 2ol

Arch. 221 Design II (0-12) 400

Application of Design principles to simple architectural problems such as basic shelter, furniture, small house, shop. pre-req: Arch. 1o2, Arch. 112.

Arch. 222 Design II (0-12) 400

Extension of Arch. 221. simple building and site problems. pre-req: Arch, 221.

Arch. 232 Building Materials (1-3) 200

Technical aspects of structural materials nature & use. Concrete, steel, bricks, wood, etc. detail sketches.

Arch. 241 Art & civilization (2-0) 2oo

study of the various arts and their relation ship to Architecture thru the ages.

Arch. 262 Basic Planning (2-0) 200

Theories of Planning. Introduction to Community, City and Regional Planning, with study of examples.

Arch. 265 Climatology (2-0) 200

Study of the nature and elements of climate and their effect on Architecture.

Arch. 303 Sculpture (0-3) 100

Studies in clay, wood, metal, etc. Pre-req : Arch. 102.

Arch. 306 Art and Music Appreciation (1-0) 100

Study of professional work in painting, sculpture, ceramics, music, etc.

Arch. 316 Working Drawings (0-3) 100

Details of drawing for construction of buildings : plans, elevations, sections, large scale details, schedules, etc. Pre-req : Arch. 235.

Arch. 321 Design III (0-15) 500

Architectural problems of medium magnitude such as small school, bank, mosque, restaurant, office building, housing development, clinic, library, fire station, post office, etc. Pre-req : Arch. 222

Arch. 322 Design III (0-15) 500

Extension of Arch. 321. Architectural problems of limited size, including site development. Pre-req: Arch. 321.

Arch. 335 Finish Materials (2-0) 200

Technical aspects of finish materials—nature and use Terrnzzo, plaster, roofing glass, paint, insulation, plastic, etc. Detail sketches. Pre-req :-Arch. 235.

Arch. 341 History of Architecture (3-0) 300

Ancient Architectre, thru classic and Romanesque. Pre-req : Arch. 242.

Arch. 342 History of Architecture (3-0) 300

Gothic Architecture, thru post-Ranaissance. Pre-req : Arch. 341.

Arch. 370 Experience : 6 week during vacations in office or field work related to Architecture.

Arch. 415 Details and Specifications (1-0) 100

Written details answering What ? Where ? When ? How ? in relationship to drawn details for building construction. Pre-req: Arch. 316.

Arch. 421 Design IV (0-15) 500

Larger buildings, more detailed development.

Perhaps stadium, hospital, hotel, industrial plant. pre-req: Arch. 322.

Arch. 422 Design IV (o-15) 500

Extension of Arch. 421. architectural problems of larger scope, including site and area development. pre-req: Arch. 421.

Arch. 441 History of architecture (3-0) 300

Contemporary architecture ; 20th century. pre-req: Arch. 342.

Arch. 442 History of Architecture (3-0) 300

Study of Ancient to modern Architecture in pakistan. India Sub-continent and neighbouring area. pre-req : Arch. 441.

Arch. 461 Physical Planning (2-3) 300

Advanced theories of planning. application of principles to solve problems of small and large areas, pre-req: Arch. 261

Arch. 462 Landseape Design (1-3) 200

Site Design. Introduction to plant materials and their use. Application to design problems.

Arch. 470 Experience. 6 weeks during vacations in office or field work related to Architecture.

Arch. 502 Art Expression (0-3) 100

Individual choice of media for advanced Study. pre-req: 5th year classification.

Arch. 507 Graphic Reproduction (1-3) 200

Principles of composing good photographs of buildings and interiors. Developing and printing of film. Presentation. Blue printing and other printing Processes

Arch. 521 Design V (0-21) 700

Building groups such as shopping center, community center, campus, airport, industrial complex, etc. pre-req. Arch.422

Arch. 522 Design V (0-21) 700

Extension of Arch. 521. Thesis. detailed design carried out like professional job. Pre-req. Arch. 521.

Arch. 572 Professional Practice (2-0) 200

Procedures in office and in field. Professional ethics. Client relationships. contracts & law. Pre-req. 5th year classification.

II. HUMANITIES SUBJECTS

Hum. 101 English Composition (2-0) 200

Composition, oral and written, readings in

modern prose (nonfiction). Language study and mechanics of writing.

Hum. 103 English Literature (2-0) 200

Reading in types such as plays, stories, novels, poems-chiefly modern. Papers on readings.

Hum. 106 Hum. 106a Bengali Literature (3-0) 300

Hum. 106b Urdu Literature (3-0) 300

Hum. 106c English Literature (3-0) 300

Readings and papers in literature.

Hum. 112 Logic (3-0) 300

Introduction to inductive and deductive logie. Thought, propositions, syllogisms, fallacies, cause, hypothesis, analogy.

Hum. 123 World History (3-0) 300

Outline of History from ancient to recent.

Hum. 124 World History (3-0) 300

Extension of Hum. 123, with emphasis on History of Pakistan area. Pre-req. Hum. 123.

Hum. 261 Geopraphy (2-0) 200

Study of human society in relation to physical conditions and natural resources of the earth.

Hum. 314 Psychology (2-0) 200

Principles of human behavior. Motivations of behavior and mechanisms of adjustment to conflict.

Hum. 322 Government (2-0) 200

Organization, function, and nature of government at various levels. Duties and rights of citizens. Public opinion and political parties.

Hum. 325 Sociology (2-0) 200

Principles of human relations, with study of contributions of biology, geography, group life and culture to development of personality. Invention and social evolution. Pre-req : 261.

Hum. 5 1 Philosophy (2-0) 200

Nature of philosophic inquiry. Relationship of philosophy to religion, science, history, politics, and education. Pre-req : 5th year classification.

Hum. 514 Speaking (1-0) 100

Speech training for technical-professional students. Group discussions. Parliamentary procedure.

Hum. 531 Economics (2-0) 200

Principles and problems of Economics. Outline of income, money and banking, price

production, public finance, international relations, labor problems.

Hum. 534 Accounting (2-0) 200

Book-keeping and accounts for technical-professional students. Study of business aspects of a profession.

III. MATHEMATICS*

Math. 101 Calculus, etc. (3-0) 300

Math. 112 Statics (Mechanics) (2-0) 200

Analysis of the external effects of a force system acting on a body at rest. Determination of section properties ; relationship to architectural structures.

IV. PHYSICS*

Phys. 201 Physics (for Architects) (3-3) 400

Fundamentals of Mechanics, Heat, sound. Scientific measurements.

Phys. 202 Physics (for Architects) (3-3) 400

Extension of phys. 201. Fundamentals of

electricity and light. Illuminating and color. Contemporary physics in relation to architectural research.

V. MECHANICAL ENGINEERING*

M. E. 101 Carpentry and Metal (0-3) 100
Use of handtools and machines for basic wood framing and simple cabinets of wood and other materials.

M. E. 102 Carpentry and Metal (0-3) 100
Extension of M. E. 101. Making of simple furniture with various materials. Pre-req : M. E. 101.

M. E. 401 Mechanical & Electrical for Buildings (2-0) 200
Lighting, electrical power, cooling, heating and ventilating, and sanitary equipment for buildings, design, selection, installation. Pre-req : Physics 202.

M. E. 402 Mechanical & Electrical for Buildings (2-0) 200
Extension of M.E. 401. Engineered operating systems for buildings. Pre-req: M.E. 401.

VI. CIVIL ENGINEERING*

C. E. 311 Plane Surveying (0-3) 100
Principles of surveying. Use of transit and level, boundaries, areas, profiles.

C. E. 351 Structures III (3-0) 300
Fundamental strength of materials analysed.

C. E. 352 Structures III (3-0) 300
Analysis and design in steel and wood.

C. E. 438 Cost Estimating (1-0) 100
Figuring the costs of building construction.

C. E. 451 Structures IV (2-3) 300
Analysis and Design of reinforced concrete structures.

C. E. 452 Structures IV (2-3) 300
Analysis and Design of various structural systems for roofs.

C. E. 551 Structures V (2-0) 200
Advanced studies in systems of architectural structures.

C. E. 552 Structures V (2-0) 200
Study of structural problems as related to professional practice : special consideration of design factors, new materials, codes, economy.

*Subjects to be arranged with Faculty of Engineering which includes these Departments.

CURRICULA FOR MASTER OF PHYSICAL PLANNING (M. P. P.)

1st Semester	Lec. Hrs.	Ses. Hrs	Full Marks
a. 1. History of Planning	3	-	300
b. 2. Nature & Principles of human settlement	3	-	300
c. 3. Components of rural & urban environment	2	-	200
d. 4. Representation & Graphic techniques (studio)	-	9	300
e. 5. Economics & Planning	2	-	200
f. 6. Geography & Planning	2	-	200
g. 7. Sociology & Planning	2	-	200
	14	9	1700

2nd Semester			
h. 1. Theories of Planning (urban & rural)	3	-	300
i. 2. Principles of urban & rural land use	3	-	300
j. 3. CityPlanning techniques (studio)	-	6	200
k. 4. Urban Aesthetics	3	-	300
l. 5. Surveying techniques & principles	2	3	300
m. 6. Statistics & Research method	2	-	200
d. 5. Representation & Graphic techniques (Studio)	-	3	100
	13	12	1700

3rd semester

		Lec. Hrs.	Ses. Hrs.	Full Marks
n.	1. Regional development-Planning and resources use	3	-	300
o.	2. Regional planning problems (Studio)	-	9	300
p.	3. Housing	3	-	300
q.	4. Municipal Engineering & Highway Traffic Engineering	2	3	300
r.	5. Directed Studies	-	3	100
s.	6. Landscape Design	2	3	300
		10	18	1600

4th Semester

t.	1. Village Planning technique (Studio)	-	9	300
u.	2. Planning administration & laws	3	-	300
v.	3. Seminar	3	-	300
w.	4. Thesis	-	18	600
		6	27	1500

DETAILED SYLLABUSES OF M. P. P.

A. History of Planning.

Origins and evolution of City Planning :

a. Development and Planning in the ancient world

b. ,, ,, ,, medieval ,,

c. ,, ,, ,, modern ,,

The role of cities in civilization—the historical origin of their institutions and physical forms.

B. Nature and Principles of Human Settlement :

Early human settlements, nature of human ecology Ecology and spatial movement, the agrarian revolution and urban growth-commerce and the growth of cities. Conditions of city growth in pre-industrial countries. Basic concepts of urban ecology. Theories of urban ecology. The rural-urban fringe. Changing residential patterns. Ecological segregation and invasion. Ecology of urban institutions.

C. Components of Rural and Urban Environment :

Distinction between urban and rural areas. Definition of region and regionalism. Physical nature, characteristic,

extent and component of rural and urban environments, Land uses residential, agricultural commercial, industrial and institutional etc. Circulation systems regional transit systems, streets, alleys, by-lanes:

D. Representation and Graphic Techniques :

Use of graphic techniques to record or control the environment and to express ideas ; freehand drawing, elementary drafting, mapping, three-dimensional models, diagrams ; graphic presentation. The commcn principles underlying these techniques and their use as tools in analysis, (for entering students without background in design fields.)

E. Economics Planning :

Physical planning as the 'space dimension' of national economic planning. Economic development vs. regional growth. Economic space, nature and principles of economic regions. Location theory localization Economics, Urbanization Economics, Agricultural Location theory. Industrialization, Factor Markets and Agricultural Development. Role of cities in social transformation of economically advanced areas. City size distribution and economic development etc.

F. Geography and Planning :

Principles of Physical Geography, Climatology, Economic Geography and Urban Geography. City and Regions. Urban and Rural Settlements trends and characteristics of development.

G. Sociology and Planning :

Structure and functions of the human settlement from the social science point of view. Individual responses to physical socio-cultural environment. Social organization and power structure in relation to social change and social mobility. Human ecological concepts in relation to community structure, functions and hierarchical orders. Investigation of methods of solving social problems through planning. Analysis of social stratificattion and community tensions in the Urban community. Community organization and cultural frame work.

H. Theories of Planning : (Urban and Rural)

Basic concept and theory of planning the relationship of physical planning to the general theory and process of planning. The application of modern advadced theories of urban planning methods and techniques. The expanding role of physical planning and its relationship to governmental organization for administration in developed and developing countries. Rural Planning as basic arrangement to offer minimum Urban amenities to the rural community. Responsibility of the State in Rural Planning.

I. Principles of Urban and Rural Landuse :

The influence of natural elements, economic, technological, social and other factors which effect the physical environment of the city and the rural areas. The factors of urbanization,

industrial location theory, land values and rent. Land use problems and the pattern of urban growth in developing countries. City structure and size vs. economic development (national income considerations).

J. City Planning Techniques : (Studio)

Techniques of survey analysis and design methods and practices in comprehensive planning : population and economic development, land use, circulation, other components of the city or metropolitan general plan relationship of planning to implementation and control, zoning, urban renewal etc.

Preparation of Development Plans and Mater Plan Reports for functional areas on a community wide basis.

K. Urban Aesthetics :

The city and its components as aesthetic elements. Development of the form of the urban environment influence of utopian and ideal concepts. Analysis of the functioning, effects and implications of the general form of the urban physical environment. Effect of this form on basis human objectives. Role of plan organization, spatial relations, symbol, silhouatte, scale, view, movement, light, color, sound detail, etc.

L. Surveying Techniques and Principles :

(a) Definition classification and Importance of Surveying-Chain surveying definition and procedures etc. Prismatic

surveying Prismatic compass use and procedures etc. Plane table surveying definition. Procedures and methods of plane tabling. Levels and Levelling contouring, study of Aerial photographs etc·

(b) Techniques of land use Survey

(c) Techniques of Socio Economic Survey.

M. Statistics & Research method :

Introduction to elementary statistical methods: The collection and presentation of statistical facts: measures of average, measures of dispersion, sampling and sampling errors. Uses and limitations of quantitative research.

N. Regional Development-Planning & Resource Use:

Theories and principles of resource use and their limitations in regional development human and non-human resources, movable and imnovable resources, changes in the concept of resources and their uses. Problems of resource allocation and efficient distribution of activities. Review of resource use policy in the U. S., U. K. and some developing countries with special emphasis to Pakistan. Techniques of planning in regional development.

O. Regional Planning Problems (studio):

Advanced Problems in city and regional planning including Pioneering studies and studies in specialised

areas. Practical application of city and regional planning theory to towns, cities and regions. Region and its resources, basic data on regional study. Group projects regarding the physical planning of the region. Region as a development project.

P. Housing

Definition of Housing. Its influence on man, society and environment. General Problems of housing inventory in Pakistan, special reference to East Pakistan. Problems of private enterprise, government, consumer, home ownership, land values, building codes, financing Procedures, production and marketing of housing industry, minimum standards Crowding and health full housing : Housing policies in developed and developing countries, Principles of Housing Design and Layout.

Q. Municipal Engineering & Highway Traffic Engineering:

Urban utilities study of transportation organization and management in municipal as well as city and national level, high-way-Planning, history inventory road use studies and program planning. Location, design, construction of high-ways, super-highway cost estimates, highway finances, provincial and central legislations. Specification and other constructional works, traffic movement, vehicular characteristic, capacity, Parking regulation, intersection and road design. Traffic planning studies.

R Directed Studies:

Preparation for thesis, Research, organised field study and/or review of books and periodicals. Specialized studies e.g. Air Port Planning, campus Planning etc.

S. Landscape Design:

Landscape Influence of natural factors of geology, soils and climate, Concious design of parks and gardens, and open spaces in towns. Composition, scale, proportion harmony and contrast in the creation of urban spaces, building groups and building facades.

T. Rural Planning:

Distinction between rural and urban areas. Historical background of rural settlements trend of development· Essential prerequisites of a community. Study of resources Agricultures in the National economy & Agricultural Planning Demography Land use pattern. Physical and economic problems in the community. Industry in Rural areas Co-operatives Capital and the community. Electricity in Rural Development. Better housing in the villages, small Rural Towns, small water sheds as unit of planning Rural Recreations. Village Govt and Planning Institutions.

U. Planning Laws and Administration :

Enabling legislation, Eminent Domain, Police Power, Planning Laws in Pakistan, Development plans. The meaning of development. The control of development including plann-

ing permission, development orders, special forms of control. The enforcement of planning controls. Purchase notices, New Towns development Compensation betterment problem, including compensation for restrictions on development and compensation for compulsory purchase.

Urban Renewal practices.

V. Planning seminar :

Examination of selected Planning Problems and research topics, such as Urbanization problem, Housing problem, Transportation Requirements and Planning, problems of Resource allocation and efficient distribution of activities, problems of Implementation of planning etc.

W. Thesis ;

Selection of thesis subject and preparation of thesis outline. Independent study, supplemented by frequent individual conferences with staff members.

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