Educational (189) Department.

ORDINARY MS.

G.O., No. 444

Dated 22nd July 1896

INDEXED.

C

[Despatch Abstract.]

College of Engineering

Approving the revised Syllabuses of the —.

BACK PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.

FURTHER PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.
Cwo	151 of 1897					
cwo	184 of 00					
FIC	1049/07					

REMARKS.

No change is proposed in the syllabus now followed for the artisan class.

REMARKS.

Vide remarks above.

l measurements.

ntities.
ities.
ities.
ng out quantities.

l or actual measure-

Oblique arches. Drawing
measurement. Estimates.

or timber and iron combined.
Drawing timber bridges from

d bars. Rivets. Construc-
tiffeners, covers, wrappers.
cross girders. Superstruc-
der foundations. Drawing
measurement. Estimating.

ge, distribution and regu-
Head sluices. Distribution
ets. Tank escapes. Tank
rom models, or specification.

Bolts, nuts, keys and cotters.
r and bevil wheels. Con-
le machines, such as a lathe,

l signs. Map-drawing.
ns on contoured plans. Hill-

ATES

Course.

precise order given below.

or isometric projection, and

or isometric projection, and

tails, two sheets.
of a building.

ng out quantities.
s. Taking out quantities.
king out quantities.
ng out quantities.
. Taking out quantities.

g out quantities.

REMARKS.

List of plans and estimates to be prepared by students during their college course has been omitted on the recommendation of the Committee in which the Principal has concurred.

Obli
neasur
r timb
Drawi

ASS.

d bar by the aid of the Blackboard
tiffe be from copies. The Teacher
cro to the class, after which each
der f way. The main object to be
ld be made intelligent drafts-
meas n Building and Bridge con-
used.
aspect works. Written reports
de, and the note-books contain-
metsar with the plans and estimates
rom

ed is not intended to be closely
ent's work, which should never
Bolt a time. Thus, at the outset, a
r apartly to a lecture, and partly
le m in drawing details of Building

l Use of drawing instru-
ns o at lines. Construction of
lines and circles. Regular
to a triangle. Parabola.
AT n of a point in space in all
of projection. Plans and
ular and polygonal prism,
C pyramid, cone and cylinder
prec ade by any plane. Inter-

awing.—Ornamental out-
ngs. Linear and angular
res. Projection of simple
rspective applied to model

nventional rules for shade
tails of masonry, such as
relieving arches. Details
oors, windows, staircases.
f, roof-coverings, fire-proof
ns, cast-iron columns, iron-
acing on cloth. Drawing
measurement. Taking out
stimates of quantities and

s.
kd embankments. Retain-
ons by plotting. Estima-

n rock, or on wells. Con-
h empiric rules for their
any centered. Modes of

REMARKS.

A revised syllabus has been drawn up with reference to the recommendations of the Committee. The Principal considers that the class should study and be examined in Building Construction and that it would be advantageous for the students to have some practice in Carpentry.

ıted in the field, and
Field book.
and. Contours to be
book.
h the level. Field

A.

ld.
heodolite. Measure-
Plotting. Field book.

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liavaram:

REMARKS.

The Committee has rightly decided to omit a description of survey plans to be prepared by students while under instruction. The details should ~~and ought rightly~~ be left to the discretion of the Principal.

REMARKS.

Adjustments. Reduction of
it of heights and distances.

theodolite. Everest's theodo-
angles.
heodolite. Gale's traverse
ag in with compass or plane

Laying out curves (1) by
ference.
reduction of base line. Ill-
Checking angles and sides.
Interior filling in.

LANS

e Course.

cise order here indicated, but the

t four sheets.
the field. Station and tie-
Field book.

igns, in colour.
the field, showing all details.

oured.
le.
acres, executed in the field.
a estimated. Field book.
res. Details to be filled in
made and finished. Field

ile executed in the field, and

ed. Field book. Check and

ections every 200 feet, run in
above, but plotted on separate

ile long, with cross sections

mile long, with cross sections
at every 660 feet for a canal.
ctions at every 660 feet, run in
lotted to show formation level.

with chain and box sextant.

S.

ASS.

t a practical surveyor. With this
nto squads, which will work inde-
of the smallest number of students
quad will interchange duties once a
ery duty, whether it be observing,

rds, will leave them to their own
east once a day, and will see that a
will further by daily instrumental
f the work performed. Inaccurate
o divisions of the class will occupy
months of April and May.

d triangles. Similar figures.
ords and tangents of circles.
gle. Quadrilateral. Regular
n's rule.

nd scales. Printing. Sim-
1) to draw a line perpendi-
given line; (2) to divide a
of equal parts; (3) to reduce
tion of areas. The construc-
Conventional signs. Tracing
uring. Pantagraph. Plani-

Incorrect chain. Chaining
Cross staff. Optical square.
nes. Field book. Plotting.

ompasses. Measurement of
gles. Field book. Plotting
rpolation.
ble.

heir adjustments. Levelling
ench marks. Datum line.
ions. Corrections for curva-
l. Water level. Reflecting
annel. Centre line. Forma-

Drawing contours on plane
gradient. Contouring with
(2) by levelling along parallel

ng with the brush. Shading

ctions. Use of logarithmic

REMARKS.

With a view to meet the full demand of the P.W.D. for trained lower subordinates fitted to carry out satisfactorily the minor details of work devolving on the upper subordinates of that department, the development of the Surveyor class into Sub-Overseer and Surveyor class has been suggested by the Committee, and the Principal has expressed himself in favour of the proposal in preference to the suggestion made by him previously to develop the Artisan into a Sub-Overseer class, and this proposal has my ~~strong~~ support. Major Love has prepared a fresh syllabus for the new class, which includes certain subjects not recommended by the Committee, but instruction in which he thinks necessary to get exactly the stamp of men required for the post of Sub-Overseer, and it has been adopted here. The designation of the class suggested by the Principal has been adopted, as indicating the offices for which the men trained in the College are eligible.

REVISED.

SYLLABUSES.

ENGINEER CLASSES.

I.—PURE MATHEMATICS. MARKS, 450.

A.—ALGEBRA (75).

Binomial theorem. Use of logarithms. Interest and discount. Indeterminate co-efficients. Roots and co-efficients of equations. Partial fractions. Summation of series. Approximate solution of equations by Horner's method.

B.—GEOMETRY (100).

(1) **Conic Sections.**—Chief properties of the parabola, ellipse and hyperbola.

(2) **Co-ordinate Geometry.**—Simple problems on the straight line, circle, parabola, ellipse and hyperbola, referred to rectangular and polar-co-ordinates.

C.—MENSURATION* (75).

Plane and solid.

D.—PLANE TRIGONOMETRY† (75).

Practical use of logarithms. Solution of triangles. Calculation of areas. Adaptation of formulæ to logarithmic computation. Heights and distances.

E.—DIFFERENTIAL AND INTEGRAL CALCULUS (125).

Differentiation of simple functions. Theorems of Taylor and Maclaurin. Curve tracing. Maxima and minima of functions of one variable. Simple cases of integration. Rectification of curves. Areas and volumes. Moments of inertia. Mechanical integrators.

* In Mensuration actual measurements of models and other objects will be made.

† In Plane Trigonometry special attention will be paid to the practical solution of triangles required in surveying.

PRESENT.

SYLLABUSES.

ENGINEER CLASSES.

I.—PURE MATHEMATICS. MARKS, 475.

A.—ALGEBRA.

Representation of unknown quantities. The signs plus and minus. Use of brackets. Numerical evaluation of algebraic expressions. Addition. Subtraction. Multiplication. Division. Highest common factor, and lowest common multiple of two or more expressions. Fractions. Involution and evolution. Indices. Simple equations. Quadratic equations. Simultaneous equations. Permutations and combinations. Binomial theorem. Use of logarithms. Interest and discount. Indeterminate co-efficients. Roots and co-efficients of equations. Partial fractions. Summation of series. Approximate solution of equations by Horner's method.

B.—GEOMETRY.

(1) **Euclid.**—Books I—IV, VI and XI up to Proposition 21, with definitions of Book V; also easy deductions.

(2) **Geometrical Conic Sections.**—The chief properties of the parabola, ellipse and hyperbola.

C.—ARITHMETIC.

The whole subject.

D.—MENSURATION.

Plane and solid.

E.—TRIGONOMETRY.*

Angular measurement, degrees and radians. Use of signs in denoting direction. Trigonometrical functions. Formulæ including angles which have the same sine, cosine or tangent. Trigonometrical functions of the sum or difference of two angles, with special cases. Practical use of logarithms. Solution of triangles. Adaptation of formulæ to logarithmic calculation. Heights and distances.

F.—ALGEBRAIC GEOMETRY.†

Definition of co-ordinates. Determination of a point. Representation of a locus by means of an algebraic equation. Equation of a straight line. Systems of straight lines. Conditions of parallelism and perpendicularity. Angle between two straight lines. Areas of triangles and rectilinear figures. The circle, various forms of its equation and of the equations of chord and tangent. The parabola, its equation referred to its axis and the tangent at the vertex as co-ordinate axes. Equations of chord, tangent,

* Special attention will be paid to the practical solution of triangles required in surveying.

† Rectangular co-ordinates only.

REMARKS.

A.—Such portions as form subjects of the F.A. and College entrance examinations have been omitted as they need not form part of the College course again.

B.—Euclid.—Books I, II, III, IV and VI have been omitted for the above reason. Book XI, with definitions of Book V, will be added to the portion prescribed for the College entrance examination. The descriptive heading given in the University by-laws has been adopted for B (2) and F with the addition of hyperbola under co-ordinate geometry as recommended by the committee.

C.—Omitted as the subject is fully disposed of at the Matriculation Examination.

D.—MENSURATION.—Repeated as sub-section C.

E.—The designation of the sub-section (now D) has been modified into 'Plane Trigonometry' which is the appropriate term; and the portion to be brought up has been reduced with reference to the remark against 'Algebra.'

F.—Has been merged in B.

REVISED.

II.—SCIENCE. MARKS, ~~400~~ 325

A.—PHYSICS* (~~300~~).

(1) **Kinematics.**—Uniplanar displacement. Translation and rotation. The instantaneous centre. Motion, relative and absolute. Velocity and acceleration, and formulæ connected with them. Parallelograms of velocities and accelerations. Angular velocity. Uniform motion in a circle. Simple harmonic motion.

(2) **Dynamics.**—Mass, density and momentum. Newton's Laws of Motion.

(*a*) *Statics.*—Definition and measurement of force. Parallelogram of forces. Triangle and polygon of forces. Composition and resolution of forces in one plane. Parallel forces. Couples. Theory of moments. Conditions of equilibrium of a system of uniplanar forces. Mass centres. Laws of friction. Principle of work and its application to machines.

(*b*) *Kinetics.*—Equations of motion deduced from Newton's second Law. Conservation of momentum. Definition and measurement of work and energy, potential and kinetic. Gravity. Attwood's machine. Projectiles. Constrained motion. The simple pendulum. Moment of inertia and radius of gyration. Centre of percussion. Ballistic pendulum.

(3) **Hydrostatics.**—Fluids. The transmission of fluid pressure. Pressure of a fluid on a plane area. Centre of pressure. Pressure of a fluid on bodies wholly or partially immersed. Principle of Archimedes. Conditions of equilibrium of floating bodies. Metacentre. Density. Specific Gravity. Determination of specific gravities of solids by means of Spe-

* The course in mechanics will be taught with the aid of experimental apparatus, and will have a special bearing on engineering problems. Instruction in hydrostatics will be given with the aid of apparatus, and students will be exercised in the practical determination of specific gravities.

PRE

and normal in various forms. The
The eccentric angle. Equations of c
of the hyperbola.

G.—DIFFERENTIAL AND INT

(1) **Differential Calculus.**—Defi
entials. Differential co-efficients. R
ferentiation of sum, difference, prod
tiation. Leibnitz's theorem. Diffe
logarithmic functions. Maxima and
Maclaurin. Curves. Equation of ta
gular points. Curve tracing.

(2) **Integral Calcula.**—Definitio
functions. Integration of algebraic
fractions. Integration by substitut
of reduction. Definite integrals. R
areas and volumes. The planimeter
The integrator. Determination of ma

II.—SCIENC

A.—PHYSICS.*

(1) **Kinematics.**—Uniplanar disp
The instantaneous centre. Motion,
acceleration, and formulæ connected
cities and accelerations. Angular v
Simple harmonic motion.

(2) **Dynamics.**—Mass, density a
Motion.

(*a*) *Statics.*—Definition and m
of forces. Triangle and
resolution of forces in o
Theory of moments. C
uniplanar forces. Mass
Machines with and with
work and its application

(*b*) *Kinetics.*—Equations of m
Law. Conservation of m
ment of work and ene
Attwood's machine. Pr
simple pendulum. Mon
D'Alembert's principle.
Centre of percussion.

(3) **The Theory of Elasticity.**—
and strain. Hooke's law. Modulus
Oersted's piezometer.

* The course in mechanics will be tau
and will have a special bearing on enginee
will be given with the aid of apparatus, an
determination of specific gravities.

SENT.

ellipse, various forms of its equation.
hord, tangent and normal. Equation

EGRAL CALCULUS.

ition of function of a variable. Differ-
ates. Velocity and acceleration. Dif-
ct and quotient. Successive differen-
rentiation of algebraic, circular and
minima. Theorems of Tailor and
gent and normal. Curvature. Sin-

n of integral. Integration of simple
functions by resolution into partial
on. Integration by parts. Formulæ
ctification of curves. Calculation of
. Calculation of moments of inertia.
ss centres and centres of pressure.

E. MARKS, ~~325~~.

lacement. Translation and rotation.
relative and absolute. Velocity and
with them. Parallelograms of velo-
elocity. Uniform motion in a circle.

nd momentum. Newton's Laws of

easurement of force. Parallelogram
polygon of forces. Composition and
ne plane. Parallel forces. Couples.
nditions of equilibrium of a system of
centres. ~~Tension~~. Laws of friction.
out friction. The principle of virtual
to machines. Efficiency of machines.
tion deduced from Newton's second
momentum. Definition and measure-
rgy, potential and kinetic. Gravity.
ojectiles. Constrained motion. The
ent of inertia and radius of gyration.
Impact and impulsive tensions.
Ballistic pendulum.

Elasticty. The elastic limit. Stress
of Elasticity. Elasticity of Volume.

ht with the aid of experimental apparatus,
ing problems. Instruction in hydrostatics
tudents will be exercised in the practical

Reaction at joints. Tension of strings. Elastic strings.

REMARKS.

G.—Appears as sub-section E. The descriptive heading given in the University by-laws has been adopted.

A (2).—The portions struck out are considered unnecessary by the committee and the Principal.

A (3).—Has been omitted as the subject is appropriately dealt with in connection with 'Applied Mechanics' under 'III Engineering.'

REVISED.

cific gravity balance, Nicholson's hydrometer, and Specific gravity bottle. Specific gravity of liquids. Hydrometers of variable immersion. The general phenomena of capillary elevation and depression.

Machines for raising Water—The principles underlying the action of the Suction Pump, Force Pump, Centrifugal Pump, and Jet Pump. The Hydraulic Press. The Siphon.

(4) **Pneumatics.**—Expansibility of gases. Weight of air. Torricelli's experiment. The cistern and aneroid barometers. Laws of Boyle and Charles. Regnault's experiments. Pressure gauges. The Air Pump. Balloons.

(5) **Heat.**—Distinction between Heat and Temperature. Methods of measuring Temperature. Physical effects of Heat. Linear and cubical expansion of solids. Expansion of liquid and gases. The compensated pendulum. Change of State. Latent heat. Behaviour of water when heated. Saturated Steam. Cold produced by evaporation. Dew point. Clouds, rain, hail, snow. Specific heat. Calorimetry. Convection of heat. Chimney draught. Conduction, reflection, radiation and absorption of heat. Conservation of energy. Laws of Thermodynamics.

B.—CHEMISTRY (100).

(1) **Preliminary.**—Elementary and compound substances. Solids, liquids and gases. Metals and non-metals. Illustrations of chemical action. Laws of chemical combination. Dalton's atomic theory. Principles of chemical nomenclature. Symbolic notation, formulæ and equations. Calculation of the weights of substances involved in chemical reactions.

(2) **Air.**—Simple chemical investigation of the composition of air. Proof synthetical and analytical that it is a mechanical mixture consisting chiefly of the two elementary gases, Oxygen and Nitrogen. Chief properties of these two elements and methods by which they may be prepared.

PRESENT.

(4) **Hydrostatics.**—Fluids. Th
sure of a fluid on a plane area. C
on bodies wholly or partially imm
ditions of equilibrium of floating bo
Gravity. Determination of specific
gravity balance, Nicholson's hyd
Specific gravity of liquids. Hydr
general phenomena of capillary eleva
Machines for raising Water—Th
the Suction Pump, Force Pump, C
Hydraulic Press. The Siphon.

(5) **Pneumatics.**—Expansibility
experiment. The cistern aneroid ba
Regnault's experiments. Pressure g

(6) **Heat.**—Distinction between
measuring Temperature. Thermom
tion of the Mercurial Thermometer
lying the action of other Thermomet
Physical effects of Heat. Dilata
solids. Expansion of liquid and ga
pensated pendulum.

Change of State:—1, From solid
Latent heat. Freezing mixtures.
Ebullition. Vaporization and cond
boiling point. Vapour pressure. Sa
tion. Mixture of gases and vapou
The dew point. Hygrometry. Clou
Calorimetry.

Convection of heat in liquids and
buildings by air currents. Chimney
Conduction of Heat. Reflection,
Principle of the Conservation of
work and *vice versâ*. Joule's experi
Laws of Thermodynamics.
Sources of heat. Solar radiation.

B.—CHEMISTRY.

(1) **Preliminary.**—Elementary
liquids and gases. Metals and no
action. Laws of chemical combin
ciples of chemical nomenclature. S
tions. Calculation of the weights o
actions.

(2) **Air.**—A simple chemical in
Proof synthetical and analytical tha
chiefly of the two elementary gase
perties of these two elements and m

transmission of fluid pressure. Pres-
ntre of pressure. Pressure of a fluid
sed. Principle of Archimedes. Con-
ies. Metacentre. Density. Specific
ravities of solids by means of Specific
meter, and Specific gravity bottle.
meters of variable immersion. The
ion and depression.
e principles underlying the action of
ntrifugal Pump, and Jet Pump. The

of gases. Weight of air. Torricelli's
ometers. Laws of Boyle and Charles.
uges. The Air Pump. Balloons.
Heat and Temperature. Methods of
ic Scales. Construction and gradua-
Construction and principles under-
rs.
on. Linear and cubical expansion of
es. Effects of expansion. The com-

o liquid. 2, From liquid to gaseous.
Behaviour of water when heated.
nsation. Effect of pressure on the
turation. Cold produced by evapora-
s. Condensation of aqueous vapour.
s, rain, hail and snow. Specific heat.

gases. Ventilation and warming of
raught.
Radiation and Absorption of Heat.
Energy. Convertibility of heat into
ents.

Internal heat of the earth. Fuels.

nd compound substances. Solids,
metals. Illustrations of chemical
on. Dalton's atomic theory. Prin-
bolic notation, formulæ and equa-
substances involved in chemical re-

stigation of the composition of air.
is a mechanical mixture consisting
Oxygen and Nitrogen. Chief pro-
ds by which they may be prepared.

REMARKS.

The alterations under 6 (revised 5) heat have been rendered necessary as the wording of the present syllabus is considered somewhat redundant.

REVISED.

(3) **Water.**—A similar investigation of the composition of water, demonstrating that it is a chemical compound formed by the union of the two elementary gases, Oxygen and Hydrogen. Preparation and properties of Hydrogen.

(4) **Chlorine,** Bromine and Iodine. Their sources, preparation, and properties. Hydrochloric Acid.

(5) **Sulphur.**—Its properties, occurrence in nature, and allotropic modifications. Preparation and properties of Sulphuretted Hydrogen. The acid-forming oxides of Sulphur and their oxy-acids. Sulphuric Acid.

(6) **Nitrogen.**—Preparation and properties of Ammonia. Compounds of Nitrogen and Oxygen. Nitric Acid.

(7) **Carbon.**—Its occurrence in nature, allotropic forms, and their principal properties. Coal. The two oxides of carbon. Carbonates.

(8) **Water.**—Permanent and temporary hardness. Processes for obtaining soft water. The most common impurities of water, their sources, and simple methods of detecting them. Filters. Sources of water. Sources of contamination. Simple methods of determining the suitability of water for drinking purposes. Filters. Hard and soft water. Soft and temporary hardness. Processes for softening water.

(9) **Application of Chemistry to Engineering** as shown by its value in determining the composition of Fuels, Oils, Limestones, Chalks, Clays and Cements.

As far as possible, students will receive practical instruction in the manipulation and preparation of simple forms of chemical apparatus. Practical instruction in Qualitative and Quantitative Analysis will form part of this course.

PRES

(3) **Water.**—A simil[ar] investi
demonstrating that it is a chemical
two elementary gases, Oxygen and
of Hydrogen.

(4) **Chlorine,** Bromine and Iod
properties. Hydrochloric Acid.

(5) **Sulphur.**—Its properties, occ
fications. Preparation and propert
acid-forming oxides of Sulphur and

(6) **Nitrogen.**—Preparation and
of Nitrogen and Oxygen. Nitric Aci

(7) **Carbon.**—Its occurrence in n
cipal properties. Coal. The two ox

(8) **Water.**—Permanent and tem
ing soft water. The most common
simple methods of detecting them.
of contamination. Simple methods
for drinking purposes. Filters. H
rary hardness. Processes for soften

(9) **Application of Chemistry t**
in determining the composition of
and Cements.

As far as possible, students will recei
and preparation of simple forms of ch
Qualitative and Quantitative Analysis will

C.—GEOLOGY.

(1) **Introductory Remarks.**—D
place on the surface of the earth.
action, wind, rain, frost and snow
waves. Deposition of strata in seas,
Animal life as geologic agents in m
earths' surface.

The composition and structure of

(2) **Rocks.**—1, Igneous. 2, M
composition and chief characteristic
poses.

Metamorphism of sedimentary str
perature existing beneath the surfac
Stratification of Rocks. Outcro
clinal Curves. Faults, Lodes, Veins
Structure of Rocks. Lamination
Ice. Glaciers and Icebergs. Erosio

(3) **Rivers.**—Sources of Rivers,
Valleys, Terraces, Deltas and Bars.
lands to the low.

(4) **The Sea.**—Marine denudat
shingle beaches. Bays and headlan
forming modern marine strata. P
the earth. Volcanic action. Distr

ENT.

ation of the composition of water,
ompound formed by the union of the
ydrogen. Preparation and properties

e. Their sources, preparation, and

rrence in nature, and allotropic modi-
s of Sulphuretted Hydrogen. The
eir oxy-acids. Sulphuric Acid.
properties of Ammonia. Compounds

ture, allotropic forms, and their prin-
ies of carbon. Carbonates.

rary hardness. Processes for obtain-
mpurities of water, their sources, and
Filters. Sources of water. Sources
determining the suitability of water
d and soft water. Soft and tempo-
g water.

Engineering as shown by its value
ls, Oils, Limestones, Chalks, Clays

practical instruction in the manipulation
nical apparatus. Practical instruction in
orm part of this course.

finition of Geology. Changes taking
Denudation of land by atmospheric
; by the sea, action of tides and
lakes and estuaries. Vegetable and
difying the physical features of the

he earths' surface.

tamorphic. 3, Sedimentary. Their
Their value for Engineering pur-

ta under the great pressure and tem-
of the earth.
, Dip, Strike. Anticlinal and Syn-
nd Dykes.
Cleavage and Foliation. Snow and
and transport of matter.
Lakes and Springs. Formation of
Transport of material from the high

Formation of sand dunes and
Distribution of sediment from rivers
rvation of Fossils. Internal heat of
ion of volcanoes. Earthquakes.

REMARKS.

Sub-section C has been omitted as what is required can be taught under 'Building materials.'

REVISED.

III.—ENGINEERING. MARKS, 500.

A.—BUILDING MATERIALS, 75*.

(1) **Stone.**—Varieties met with in Southern India. Quarrying. Blasting with powder and dynamite. Dressing. Average strength and weight of stone.

(2) **Bricks and Tiles.**— Brick earth. Tempering. Hand and Machine Moulding. Drying. Burning in clamps and kilns. Hoffman's kiln. Coloured bricks and tiles. Pressed Bricks. Roofing, flooring and drain tiles. Fire bricks. Average strength and weight of brick. Characteristics of good bricks and tiles.

(3) **Lime, Cement, Mortar, Concrete, Plaster.**—Sources and properties of lime. Burning in intermittent and running kilns. Slaking. Mortar mixing. Fat and Hydraulic limes. Portland cement manufactured in England and in Madras. Hydraulic mortar. Surki. Concrete. Practical tests for limes and cements. Strength of mortars and concretes. Plaster and plastering. Pointing. White and colour washing.

(4) **Timber.**—Growth. Felling. Seasoning, natural and artificial. Conversion. Preservation of timber. Varieties of timber used in Southern India—teak, saul erool, karimaridoo, padowk, vengay, benteak, aynee, red and white cedar, rose-wood, casuarina, mango, palmyra, cocoanut, bamboo. Strength and weight of timber. Characteristics of good timber.

(5) **Metals.**—Iron ores. Smelting. Grey and white pig iron. Castings. Pipes and columns of cast iron. Chilled castings. Strength of cast iron. Brief description of the manufacture of wrought iron. Forms of wrought iron. Galvanized and corrugated iron. Tests and strength of wrought iron. Rivets and bolts. Punching and drilling holes. Riveting. Cutting plates and bars. Welding. Steel, hard and mild. The Bessemer process. Strength of steel. Copper. Zinc. Lead. Tin. Alloys. Soldering metals.

(6) **Paints and Varnishes.**—Ingredients of paint. Litharge. Turpentine. Linseed oil. Mixing paint. Painting old and new work. Wood oil. Coal tar. Distemper. Varnish. Papering. Putty. Glazing.

B.—BUILDING CONSTRUCTION (150). †

(1) **Masonry.**—Coursed and uncoursed rubble. Block in course. Ashlar. String courses. Copings. Bricklaying. English and Flemish bond. Bond at angles of walls, in footings with offsets, between main and cross walls, at door and window openings and in circular pillars. Foundations

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* During this course visits of inspection will be made to the following and other works :—

(*a*) Pallávaram stone quarries.
(*b*) Perambúr brickfields.
(*c*) Government brickfield, Poonamalle Road.
(*d*) Lime-kilns, Cochrane's Basin.
(*e*) Madras cement works.
(*f*) Gun Carriage Factory, or other foundry.

Written reports are not required, but students will submit note books of dimensioned sketches illustrative of the processes witnessed.

† Great stress will be laid on the importance of making large size detail sketches, completely dimensioned. Visits of inspection will be made to buildings in progress, and note books of sketches will be submitted. Buildings will be set out on the ground.

In connection with this subject, Building drawings will be executed as part of the Drawing course—*vide IV, Drawing.*

PRE

III.—ENGINEER

A.—BUILDING MATERIALS.*

(1) **Stone.**—Varieties met with in
ing with powder and dynamite. Dre
of stone.

(2) **Bricks and Tiles.**—Brick e
Moulding. Drying. Burning in
Coloured bricks and tiles. Pressed
tiles. Fire bricks. Average strengt
of good bricks and tiles.

(3) **Lime, Cement, Mortar, Co**
perties of lime. Burning in inter
Mortar mixing. Fat and Hydraulic
in England and in Madras. Hydrau
tical tests for limes and cements.
Plaster and plastering. Pointing.

(4) **Timber.**—Growth. Felling
Conversion. Preservation of timber
India—teak, saul erool, karimaridoo
and white cedar, rose-wood, casuari
Characteristics of strength and weig
timber.

(5) **Metals.**—Iron ores. Smelt
ings. Pipes and columns of cast iro
iron. Brief description of the ma
wrought iron. Galvanized and cor
wrought iron. Rivets and bolts. P
Cutting plates and bars. Welding.
process. Strength of steel. Copper
ing metals.

(6) **Paints and Varnishes.**—I
pentine. Linseed oil. Mixing paint
oil. Coal tar. Distemper. Varnis

B.—BUILDING CONSTRUCTI

(1) **Masonry.**—Coursed and
Ashlar. String courses. Copings. B
Bond at angles of walls, in footin
walls, at door and window opening

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* During this course, visits of inspe
works :—

(*a*) Pallávaram stone quarries.
(*b*) Perambúr brickfields.
(*c*) Government brickfield, Poona
mallee Road.

Written reports are not required, but
sketches illustrative of the processes wi

† Great stress will be laid on the i
completely dimensioned. Visits of insp
note books of sketches will be submitte
In connection with this subject, Bu
Drawing course—*vide V. Drawing.*

ENT.

REMARKS.

NG. MARKS, 775.

Southern India. Quarrying. Blast-
sing. Average strength and weight

th. Tempering. Hand and Machine
amps and kilns. Hoffman's kiln.
Bricks. Roofing, flooring and drain
and weight of brick. Characteristics

crete, Plaster.—Sources and pro-
ittent and running kilns. Slaking.
mes. Portland cement manufactured
e mortar. Surki. Concrete. Prac-
Strength of mortars and concretes.
White and colour washing.

Seasoning, natural and artificial.
Varieties of timber used in Southern
padowk, vengay, benteak, aynee, red
, mango, palmyra, cocoanut, bamboo.
of timber. Characteristics of good

Grey and white pig iron. Cast-
Chilled castings. Strength of cast
ufacture of wrought iron. Forms of
galvanized iron. Tests and strength of
unching and drilling holes. Riveting.
Steel, hard and mild. The Bessemer
Zinc. Lead. Tin. Alloys. Solder-

gredients of paint. Litharge. Tur-
Painting old and new work. Wood
Papering. Putty. Glazing.

N.†

coursed rubble. Block in courses.
ricklaying. English and Flemish bond.
with offsets, between main and cross
and in circular pillars. Foundations

---

ion will be made to the following and other

(*d*) Lime-kilns, Cochrane's Basin.
(*e*) Madras cement works.
(*f*) Gun Carriage Factory, or other foundry.

ents will submit note books of dimensioned
ed.

tance of making large size detail sketches,
will be made to buildings in progress, and
Buildings will be set out on the ground.
g drawings will be executed as part of the

REVISED.	PRESENT.	REMARKS.
and footings. Plinth. Damp proof course. Thickness of main and cross walls. Wall plates. Wood bricks and plugs. Openings for timber beams, for doors and windows. Corbelling. Flat, segmental, pointed and relieving brick arches. Inverts. Centres for small arches. Bond in brick and stone arches. Small oblique arches. Enclosure walls. Buttresses and counterforts. Retaining and breast walls. Scaffolding.	and footings. Plinth. Damp roof cou walls. Wall plates. Wood bricks and for doors and windows. Corbelling. F brick arches. Inverts. Centres for sm arches. Small oblique arches. Enclos forts. Retaining and breast walls. Sc	
(2) **Foundations.**—Excavation. Masonry and concrete foundations. Unequal settlement. Pressure on soil under foundations. Foundations on rock, good and bad soils. Piles. Coffer dams and caissons. Well foundations. Brick and iron wells. Mode of sinking wells. Patent excavators for well sinking. Setting out buildings from working plans.	(2) **Foundations.**—Excavation. M Unequal settlement. Pressure on soil u rock, good and bad soils. Piles. Coffe tions. Brick and iron wells. Mode o for well sinking. Setting out buildings	
(3) **Carpentry.**—Mortise and tenon joint. Fishing and scarfing. Iron straps and bolts. Roof and bridge frames, nature of stress in the different members. Detail of joints. Frames of timber and iron combined. Trussed beams. Timber floors. Stairs, designing and setting out. Doors and windows. Centerings for arches. Striking centres.	(3) **Carpentry.**—Mortise and tenon straps and bolts. Roof frames, nature Detail of joints. Frames of timber a Timber floors. Stairs, designing and Centerings for arches. Striking centre	
(4) **Roofs and Floors.**—Terrace roofs and floors on joists, beams and joists, or iron girders and joists. Bengal terrace roofs. Fire-proof floors. Brick arched roofs. Pitched roofs. Couples. Trusses. Rafters, purlins and reepers. Roof coverings of thatch, tiles, slates and shingles. Ceilings. Floors of stone, brick, tiles, concrete, timber and asphalte. Simple forms of iron roofs. Use of tee, angle and channel iron in compression, and of rods and flat bars in tension. Joints and connections. Shoes, rivets, bolts. Iron and timber purlins. Brackets. Patent tiles, corrugated iron, lead and zinc roofing. Modes of attachment. Ventilators.	(4) **Roofs and Floors.**—Terrace ro joists, or iron girders and joists. Ben Brick arched roofs. Pitched roofs. and reepers. Roof coverings of thatch Floors of stone, brick, tiles, concrete, ti iron roofs. Use of tee, angle and cha and flat bars in tension. Joints an Iron and timber purlins. Brackets and zinc roofing. Modes of attachmen	
(5) **Bridges.***—Names of parts. Thickness of arch ring, wing-walls, centerings. Setting out arches full size. [Simple iron bridges.]	**C.—BRIDGE CONSTRUCTION.*** (5) **Site, Waterway and Design f** of stream or river. Nature of bed and way. Estimation of velocity and discha velocity. Afflux. Choice of materia wrought iron and steel. Relative cost out. Square and skew bridges with st	
(6) **Roads.**—Road construction and maintenance. [General principles of Railway construction.]	(6) **Temporary Bridges.**—Paved sion bridges of rope, wire, chain, &c. of roadway. Swing openings. Draw or railway diversions with crib-work, p	
	(7) **Masonry Bridges.**—Solid, w putting in foundations. Flooring. A centred. Setting out such arches f Approximate rules for thrust. Des abutments. Skewbacks, cutwaters, Centerings; principles and mode of centres. Construction of arch ring i Face walls. Blocking course and para centres. Approaches. Oblique arc courses.	

* Great stress will be laid on the importance of making large size detail sketches, completely dimensioned. Visits of inspection will be made to bridges in progress or completed, and note books of sketches will be submitted. Bridges will be set out on the ground. Arches will also be set out on a floor, and skewbacks and courses marked.

In connection with this subject, Bridge drawings will be executed as part of the Drawing course.

The portions in brackets are not required for the College examinations.

* Great stress will be laid on the impo completely dimensioned. Visits of inspec completed, and note books of sketches w the ground. Arches will also be set out o

In connection with this subject, Brid Drawing course—*vide V, Drawing.*

ESENT.	
sance. Maps. Trial surveys and sec- Trial pits. Working survey and showing widths and areas required.	
out centre line. Laying out curves.	
and rail level. Over and under bridges. drains. Level crossings. Gauge. Timber and iron sleepers. ls. Fish plates. Cant of rails. Eleva- curves. Sidings. Switches and cross-	
Adhesive system. Stationary engines.	
ives. Resistances to be overcome. Trac- tion of fuel and water. Passenger gons. Brakes. nd goods stations. Locomotive and rms. Watering tanks. Signals. The s rails. Section of road. Means of ramways. Wire tramways. Traction	
ION WORKS AND SANITARY	
Hydrostatic Laws. Pressure at a point sion of pressure. Atmospheric pressure. on.	
and Notches.—Volume of flow. Prin- Velocity of discharge. Co-efficients arge Adjutages. Short pipes. Large orifice. Triangular notch. Velocity of submerged orifices. Submerged notch.	
rge from Orifices and Notches.—Tank gauging weirs. Anicuts with clear over- under, tank weir, lock and irrigation. r. Modules.	
Head.—Free discharge from prismatic ling. Discharge during a given time. ular basins. Discharge from one pris-	
—Fluid friction. Velocity in pipes. of friction. Velocity and discharge. ination of pipes. Branched mains. of head. Jets.	
—Open channels. Bazin's co-effi- rge. Trapezoidal section in earth.	
nills tank, and Madras water-supply system. ation of catchment areas will be made during els, and contouring tank basins will be per-	

Sub-section E has been altered into C, in consequence of the omission of sub-sections C and D.

In this sub-section reference to 'Sanitary Engineering' has been omitted as recommended by the committee. As 'Sanitary Engineering' is in itself an extensive subject, it cannot well be taught as a sub-head of Hydraulics. The time now available is hardly sufficient to allow of efficient instruction being imparted in Hydraulics.

REVISED.

PRESE

(8) **Timber Bridges.**—Abutments.
work. Frames of timber or timber and
Trapezoidal truss Lattice frames. Jo
Arched ribs of planks.

(9) **Iron and Steel Bridges.**—Fo
wells. Piers, abutments and wing-wal
rivets. Riveted joints. Punched an
riveting. Mode of connecting plates
Pin connections. Rolled beams. Ir
main and cross girders and superstru
Principal forms of main girders; para
open web. Detailed description of a
flanges. Detailed description of an ope
of vertical and diagonal bracing. Ot
Erection of girders. Allowance for ex
sion bridges. Wrought iron arches.

**D.—EARTHWORK, ROADMAKIN
TION.***

(*a*) **Earthwork.**

(1) *Preliminary.*—Working pla
pits. Stripping top soil.
ments. Spoil banks. S
Computation of content
Use of tables. Widths a

(2) *Setting out.*—Marking cen
out cross sections on level

(3) *Tools and Plant.*—Bevil plu
Mason's level. Wheel an
mamoties, pickaxes, shove
and hand drills.

(4) *Embankments.*—Embankmen
tings. Profiles. Punning
Formation and repair of ta

(5) *Cuttings.*—Run to embank
opening out a cutting. P

(6) *Drainage.*—Dressing and tu
age of earthworks. Retai

(*b*) **Roadmaking.**

(1) *Classification, &c.*—Fair we
gradients. Cross section
slopes. Metalling with
Specification.

(2) *Survey.*—Trial lines of leve
Culverts. Drawings and

(3) *Construction.*—Pegging ou
Earthwork. Drainage.
Rollers. Maintenance ar

(4) *Hill Roads.*—Tracing.
walls. Catchwater drain

* In connection with this subject, th
during the course in Surveying:—Pegging
of levels, and taking cross sections; settin

T.

border. Channels for variable
cross section. Falls. Standing

. Maximum flood discharge
tens' formulæ. Bends in rivers.

er.—Supply for irrigation, navi-
from wells, rivers and reservoirs.

ls of construction; foundations,
crest, aprons. Under sluices.
anicut in Southern India.

n canals in deltaic and non-deltaic
. Capacity of canal. Limiting
t. Disposal of cross drainage;
ets. Height of banks. Drops.
able canals. Limiting velocity.
bridges.

Tanks in groups. Tanks sup-
rigating duty. Loss of wate by
of earthen bunds. Puddle walls.
construction of surplus weirs.
o bunds, and closing breaches.

tity and quality required.
ress. Gravitation and pumping
ell sinking and boring. Artesian
umps. Filter beds. Sizes and
and stand pipes. Water meters.
n of lead pipes on water.

ainage of surface and subsoil.
wers. Pipes. Man holes. Out-
f sewers. Traps. Ventilators.
ication of sewage. Flushing of
Storm water.

erials.

in. Elastic limit. Modulus of
ate strength. Proof and work-

k done in stretching a bar.
on in thin cylinders. Suddenly
ation of strength of timber and
and chains. Design of tension
er and wrought ron. Riveted
lates. Strength of boilers.

reference to the application of the

subject are entered in the syllabus
e, *Framework* should be taken up
e portions of the syllabus relating
e tim devoted to Drawing.

REMARKS.

The committee would strike out paragraphs (12) and (13). But **Major Love** would retain the heading as altered to meet the requirements of the **B. E.** Syllabus prescribed by the University.

The alterations under the sub-head are mainly in the direction of reducing redundancy of expression.

REVISED.	PRESENT.	REMARKS.
100 **C.—HYDRAULIC ENGINEERING (~~150~~).** *		
(1) **Hydrostatics.**—Water. Hydrostatic Laws. Pressure at a point and on a surface. Equal transmission of pressure. Atmospheric pressure. Siphon. Specific gravity. Flotation.		
(2) **Discharge from Orifices and Notches.**—Volume of flow. Principle of continuity. Small orifices. Velocity of discharge. Co-efficients of velocity, contraction, and discharge. Adjutages. Short pipes. Large orifices. Rectangular notch and orifice. Triangular notch. Velocity of approach. Submerged and partly submerged orifices. Submerged notch.		
(3) **Practical cases of discharge from Orifices and Notches.**—Tank surplus weirs. Drowned weirs. Gauging weirs. Anicuts with clear overfall or drowned. Sluices; head, under, tank weir, lock and irrigation. Bridge openings. Afflux, backwater. Modules.		
(4) **Discharge under variable Head.**—Free discharge from prismatic vessels. Time of emptying or filling. Discharge during a given time. Canal locks. Discharge from irregular basins. Discharge from one prismatic vessel into another.		
(5) **Flow of water in Pipes.**—Fluid friction. Velocity in pipes. Virtual slope. Darcy's co-efficients of friction. Velocity and discharge. Short pipes. Siphon sluice. Inclination of pipes. Branched mains. Pipes not running full. Minor losses of head. Jets.		
(6) **Flow of water in Channels.**—Open channels. Bazin's co-efficients. Channel section. Discharge. Trapezoidal section in earth.		
* Inspection will be made of the Redhills tank, and Madras water-supply system. Drawings of Irrigation works and estimation of catchment areas will be made during the Drawing course. Levelling for channels and contouring tank basins will be performed during the Surveying course.		
	(c) **Railway Construction.**	
	(1) *Preliminary.*—Reconna tions. Bench mark section. Land plans Land Acquisition Act	
	(2) *Construction.*—Peggin Earthwork. Tunnels	
	(3) *Bridgework.*—Formatio Culverts, siphons and	
	(4) *Permanent-way.*—Balla Chairs. Forms of r tion of outer rails o ings. Platelaying.	
	(5) *Mountain Railways.*— Centre-rail inclines.	
	(6) *Rolling stock.*—Locom tive force. Consu carriages and goods	
	(7) *Stations.*—Passenger carriage sheds. Pla block system.	
	(8) *Tramways.*—Varieties draught. Single ra engines.	
	E.—HYDRAULICS, IRRIGA ENGINEERING.*	
	(1) **Hydrostatics.**—Water. and on a surface. Equal transm Siphon. Specific gravity. Flot	
	(2) **Discharge from Orifice** ciple of continuity. Small orifi of velocity, contraction, and di orifices. Rectangular notch an approach. Submerged and partl	
	(3) **Practical cases of disc** surplus weirs. Drowned weirs. fall or drowned. Sluices; head Bridge openings. Afflux, backy	
	(4) **Discharge under varia** vessels. Time of emptying or Canal locks. Discharge from ir matic vessel into another.	
	(5) **Flow of water in Pip** Virtual slope. Darcy's co-effic Short pipes. Siphon sluice. Pipes not running full. Minor l	
	(6) **Flow of water in Chan** cients. Channel section. D	
	* Inspection will be made of t Drawings of Irrigation works and the Drawing course. Levelling for formed during the Surveying course.	
	stress in a cross section. Failure d compression. Modes of failure. mulæ of Gordon, Hodgkinson and thin cylinders. Estimation of er, cast iron, and wrought iron. joints. Compression in masonry	
	Neutral axis. Shearing stress. esisting moments. Calculation of n of shearing stresses and bending tationary and moving loads. Re- ular, flanged, tee, channel, rail and al and graphical methods. Prac- trength of timber and cast iron uilt up wrought iron beams. De- l iron beams. Relation between g moment. Distribution of shear- e webs. Detailed design of a small l flanges, including covers, wrap- c. Fixed and continuous uniform moments. Deflection of solid and Permanent set. Practical mea- ility of masonry structures against ure of earth or water. e of tangential stress. Torsion. ment of resistance. Diameter of	
	Flow of solids. Apparent and true ductile and rigid material. Effect e and different stresses. Fatigue. sting of iron, cement, stone, &c.	
	mplete and incomplete frames. brium of external forces. Equili- s at each joint. Graphical method frame and stress diagrams. Au- tion, to triangular frame. Bow's	
	Effect of wind. Graphical estima- frames. Effect of changes of tem- er roofs. Strength of joints. De-	
	ive loads. Bollman truss. Tra- acing. Design of a timber bridge on of stresses in Warren, N and ation of the following methods :— Polygonal method, (iii) Shearing e effects of partial loads. De- rder. Suspension chains. Bow- girders. Arches. Determination hes.	

REVISED.

100

C.—HYDRAULIC ENGINEERING (~~150~~).*

(1) **Hydrostatics.**—Water. Hydrostatic Laws. Pressure at a point and on a surface. Equal transmission of pressure. Atmospheric pressure. Siphon. Specific gravity. Flotation.

(2) **Discharge from Orifices and Notches.**—Volume of flow. Principle of continuity. Small orifices. Velocity of discharge. Co-efficients of velocity, contraction, and discharge. Adjutages. Short pipes. Large orifices. Rectangular notch and orifice. Triangular notch. Velocity of approach. Submerged and partly submerged orifices. Submerged notch.

(3) **Practical cases of discharge from Orifices and Notches.**—Tank surplus weirs. Drowned weirs. Gauging weirs. Anicuts with clear overfall or drowned. Sluices; head, under, tank weir, lock and irrigation. Bridge openings. Afflux, backwater. Modules.

(4) **Discharge under variable Head.**—Free discharge from prismatic vessels. Time of emptying or filling. Discharge during a given time. Canal locks. Discharge from irregular basins. Discharge from one prismatic vessel into another.

(5) **Flow of water in Pipes.**—Fluid friction. Velocity in pipes. Virtual slope. Darcy's co-efficients of friction. Velocity and discharge. Short pipes. Siphon sluice. Inclination of pipes. Branched mains. Pipes not running full. Minor losses of head. Jets.

(6) **Flow of water in Channels.**—Open channels. Bazin's co-efficients. Channel section. Discharge. Trapezoidal section in earth.

* Inspection will be made of the Redhills tank, and Madras water-supply system. Drawings of Irrigation works and estimation of catchment areas will be made during the Drawing course. Levelling for channels and contouring tank basins will be performed during the Surveying course.

PRESENT.

(c) **Railway Construction.**

(1) *Preliminary.*—Reconna… tions. Bench mark… section. Land plans… Land Acquisition Act…

(2) *Construction.*—Pegging… Earthwork. Tunnels…

(3) *Bridgework.*—Formation… Culverts, siphons and…

(4) *Permanent-way.*—Ballas… Chairs. Forms of rail… tion of outer rails o… ings. Platelaying.

(5) *Mountain Railways.*—… Centre-rail inclines.

(6) *Rolling stock.*—Locomo… tive force. Consu… carriages and goods …

(7) *Stations.*—Passenger … carriage sheds. Pla… block system.

(8) *Tramways.*—Varieties … draught. Single ra… engines.

E.—HYDRAULICS, IRRIGA… ENGINEERING.*

(1) **Hydrostatics.**—Water. … and on a surface. Equal transm… Siphon. Specific gravity. Flota…

(2) **Discharge from Orifice…** ciple of continuity. Small orifi… of velocity, contraction, and di… orifices. Rectangular notch and… approach. Submerged and partl…

(3) **Practical cases of disch…** surplus weirs. Drowned weirs. … fall or drowned. Sluices; head… Bridge openings. Afflux, backw…

(4) **Discharge under varia…** vessels. Time of emptying or… Canal locks. Discharge from ir… matic vessel into another.

(5) **Flow of water in Pip…** Virtual slope. Darcy's co-effic… Short pipes. Siphon sluice. … Pipes not running full. Minor l…

(6) **Flow of water in Chan…** cients. Channel section. D…

* Inspection will be made of t… Drawings of Irrigation works and … the Drawing course. Levelling fo… formed during the Surveying course.

…tmospheric valves, stop valves, glass … pressure gauge. Feedwater heaters.

…ne.—General description of the prin… engines. Details of the construc… cylinders, the forms of slide valve … valves; the piston, metallic packing … and glands; the steam jacket and … rod, guide blocks and slides; crank … beam and parallel motions of beam … Governors, and methods of regu… surface condensers, the air pump, …mps.

…description, advantages of compound …ansion and reversing gear. Thrust … of paddle wheels and screws. The …

…he general construction of a locomo… …he inner and outer shell; the cylin… …g them; fire box stays, gusset stays, … mechanical action of the blast; the … blow-off cocks; feed pumps. The …ds and eccentries. Inside and out… …xle and driving wheels, power re… …ing wheels, sand boxes, axle boxes, …ings. Automatic and non-automatic …r tank, feed heaters, Ramsbottom's …anes.

…escription of the indicator, method …racteristics of an indicator diagram. … of calculating the horse power of an …

…G. MARKS, 500.

…ossible, follow that in Engineering. Thus, …, Bridge construction, Irrigation works or … Engineering courses, the drawing belonging …awing course. The time devoted to Draw… …one and-a-half hours each. The practice of … section paper or otherwise will be cultivated …ll occupy about two and-a-half years. The … and Machine Drawing in connection with …

…e Drawing.—Use of drawing instru… …practical plane geometry. Plans, … Isometric projection. Linear and …etrical solids and simple objects.

…ing.—Ornamental outlines. Appli… …el drawing of simple objects.

… details; bond, arching, footings, …s. Iron details; rivets, bolts, joints

REMARKS.

Sub-heads 'Marine Engines' and 'Locomotive Engines' have been dropped as being special types, acquaintance with which should not, in the opinion of the committee, be made obligatory on students. The addition to new paragraph 7 is intended to meet the requirements of the University.

A revised syllabus has been drawn up by Major Love with reference to the University requirements and the recommendations of the committee.

REVISED.	PRESENT.	REMARKS.
Practical data. Channels of minimum border. Channels for variable discharge. Variation of velocity in a cross section. Falls. Standing waves.	Practical data. Channels of minimum discharge. Variation of velocity in waves.	
(7) **Rivers.**—Estimation of discharge. Maximum flood discharge from catchment basins. Ryves' and Dickens' formulæ. Bends in rivers. Régime of rivers.	(7) **Rivers.**—Estimation of disch from catchment basins. Ryves' and Régime of rivers.	
(8) **Storage and distribution of Water.**—Supply for irrigation, navigation or to a town. Rainfall. Supply from wells, rivers and reservoirs. Water lifts and pumps.	(8) **Storage and distribution of** gation or to a town. Rainfall. Sup Water lifts and pumps.	
(9) **Anicuts.**—Selection of site. Details of construction; foundations, body-wall, binding walls, retaining wall, crest, aprons. Under sluices. Head sluice. Wings. Different types of anicut in Southern India.	(9) **Anicuts.**—Selection of site. I body-wall, binding walls, retaining Head sluice. Wings. Different types	
(10) **Canals and Channels.**—Irrigation canals in deltaic and non-deltaic country. Supply from rivers and tanks. Capacity of canal. Limiting velocities. Fall. Side slopes. Alignment. Disposal of cross drainage; aqueducts, superpassages, inlets and outlets. Height of banks. Drops. Head sluices for distributaries. Navigable canals. Limiting velocity. Locks, lock weirs, tow-paths, head-way at bridges.	(10) **Canals and Channels.**—Irrig country. Supply from rivers and t velocities. Fall. Side slopes. Align aqueducts, superpassages, inlets and Head sluices for distributaries. Na Locks, lock weirs, tow-paths, head-wa	
(11) **Tanks.**—Isolated rainfed tanks. Tanks in groups. Tanks supplied by rivers or streams. Capacity. Irrigating duty. Loss of water by evaporation and absorption. Construction of earthen bunds. Puddle walls. Revetment of earthen bunds. Design and construction of surplus weirs. Tank sluices and their regulation. Repairs to bunds, and closing breaches.	(11) **Tanks.**—Isolated rainfed tan plied by rivers or streams. Capacity. evaporation and absorption. Construct Revetment of earthen bunds. Design Tank sluices and their regulation. Re	
[(12) **Water-supply of Towns and Town Drainage.**—Brief general description.]	(12) **Water-supply of Towns.**— Clarke's soap test. Clarke's softening schemes. Supply from wells and rivers wells. Reservoirs, main and service forms of pipes. Laying pipes. Hydra Constant and intermittent systems. A	
	(13) **Town Drainage.**—Sewage. Removal of refuse. Open drains. Ova fall. Intercepting sewers. Constructi Sewage farms. Dry-earth system. P sewers. Cess-pits. Pneumatic system.	
D.—APPLIED MECHANICS (150).*	**F.—APPLIED MECHANICS.***	No syllabus has hitherto been prescribed for the examination in language. This omission has now been supplied.
(1) **Strength of Materials.**	(1) **Stiffness and Strength of M**	
(*a*) *Preliminary.*—Stress and strain. Elastic limit. Modulus of elasticity. Factor of safety.	(*a*) *Preliminary.*—Stress and s elasticity. Rupture. Ul ing load. Factor of safet	
(*b*) *Tension.*—Simple tension. Practical estimation of strength of timber and iron tension bars, and of ropes and chains. Design of tension bars and their joints in timber and wrought iron. Riveted joints. Strength of boilers.	(*b*) *Tension.*—Simple tension. Modulus of resilience. T applied load. Practical e iron tension bars, and of r bars and their joints in joints in punched and dri	

* The treatment of this subject will have special reference to the application of the principles enunciated to the practice of design.

The order in which the different branches of the subject are entered in the syllabus need not be adhered to in instruction. For instance, *Framework* should be taken up before *Bending* has been completely disposed of. The portions of the syllabus relating to Design will be carried out for the most part in the time devoted to Drawing.

* The treatment of this subject will have principles enunciated to the practice of desig

The order in which the different branches need not be adhered to instruction. For before *Bending* has been completely disposed to Design will be carried out for the most pa

REVISED.

(*c*) *Compression.*—Simple compression. Combined bending and compression. Formulæ of Gordon, Hodgkinson and Euler. Estimation of strength of struts in timber, cast iron, and wrought iron. Design of struts and their joints. Compression in masonry structures.

(*d*) *Bending.*—Simple bending. Shearing stress. Calculation of, and graphical representation of shearing stresses and bending moments in beams under stationary and moving loads. Resisting moments of various sections by analytical and graphical methods. Practical estimation of the strength of timber and cast iron beams, and of rolled and built up wrought iron beams. Design of timber and small iron beams. Detailed design of a small plate girder with parallel flanges. Fixed and continuous uniform beams. Theorem of three moments. Deflection of beams. Camber. Permanent set. Practical measurement of deflection. Stability of masonry structures.

(*e*) *Shearing and Torsion.*—Nature of tangential stress. Torsion. Diameter of shafting.

(*f*) *Strain beyond elastic limit.*—Flow of solids. Apparent and true tenacity. Compression of ductile and rigid material. Effect of repetition of the same and different stresses. Fatigue. Factors of safety. The testing of iron, cement, stone, &c.

(2) Statics of Structures.

Free joints. Complete and incomplete frames. Funicular polygon. Equilibrium of external forces. Equilibrium of forces and stresses at each joint. Graphical method of determining stresses by frame and stress diagrams. Automatic checks. Application to triangular frame. Bow's lettering. Roof frames. Vertical load. Effect of wind. Effect of changes of temperature. Design of timber and iron roof frames. Bridge frames. Dead and live loads. Bollman truss. Trapezoidal truss. Counterbracing. Design of a timber bridge frame Practical estimation of stresses in Warren, N and Lattice frames, and application of the following methods :—(i) Method of sections, (ii) Polygonal method, (iii) Shearing stress diagram, (iv) Separate effects of partial loads. Design of a simple open web girder. Suspension chains. Bow-string girders. Hinged girders. Arches. Determination of Line of Resistance in arches.

PRE

(*c*) *Compression.*—Distribution o by combined bending Attachment of ends. Euler. Compression o strength of struts in t Design of struts and th structures.

(*d*) *Bending.*—Simple bending Equality of bending and and graphical representa moments in beams unde sisting moments of recta other sections by analy tical estimation of the beams, and of rolled and sign of timber and s shearing stress and ben ing stress. Design of p plate girder with para pers, stiffeners, rivets, beams. Theorem of thr built up beams. Camb surement of deflection. overturning under the

(*e*) *Shearing and Torsion.*—N Torsional moment, and shafting.

(*f*) *Strain beyond elastic limit.* tenacity. Compression of repetition of the s Factors of safety. The

(2) Statics of Structures.

(*a*) *Framework.*—Free joints. Funicular polygon. Ec brium of forces and str of determining stresses tomatic checks. Appl lettering.

(*b*) *Roof frames.*—Vertical loa tion of stresses in simp perature. Design of t sign of iron roof frame

(*c*) *Bridge frames.*—Dead a pezoidal truss. Count frame. Practical esti Lattice frames, and ap (i) Method of sections stress diagram, (iv) S sign of a simple open string girders. Hin of Line of Resistance

ATE CLASS.

MARKS, 370.

s. The signs plus and minus. f algebraic expressions. Addin. Fractions. Highest comddition, subtraction, multiion and evolution. Indices. known quantities. Quadratic

deductions.

nctions of an angle, and their angles which have the same n or difference of two angles. es. Properties of triangles. s and distances.

t of mass and force. Geomeram of forces. The triangle olution of forces. Parallel ditions of equilibrium of a ty. Simple machines. The al work applied to machines. ith machines.

n will be paid to the practical

of experimental apparatus, and Graphical methods of solution

REMARKS.

Arithmetic has been omitted as the subject is fully disposed of at the Matriculation or Upper Secondary Examination.

Such portions of Algebra as form subjects of the Matriculation and Upper Secondary Examinations have been omitted as they need not again be taught in the College.

Books I, II and III have, for the above reason, been omitted. Book VI has been added on the recommendation of the Committee.

Elementary statistics has been omitted as the Committee considers correctly that the subject is somewhat above the class of Engineer Subordinate student and the time occupied in it is to a great degree time wasted. Major Love observes that the subject must continue to be taught as a portion of Applied Mechanics.

T. 2

ATE CLASS.

MARKS, 370.

s. The signs plus and minus. f algebraic expressions. Addi- n. Fractions. Highest com- Addition, subtraction, multi- ation and evolution. Indices. known quantities. Quadratic

deductions.

ctions of an angle, and their ngles which have the same or difference of two angles. s. Properties of triangles. and distances.

f mass and force. Geome- ram of forces. The triangle solution of forces. Parallel ditions of equilibrium of a ty. Simple machines. The al work applied to machines. with machines.

n will be paid to the practical

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T.

MARKS, 600.

thern India. Quarrying. Blast-
Average strength and weight

Tempering. Pug mills. Hand
Drying. Burning in clamps and
Coloured bricks and tiles. Fire
Patent tiles. Characteristics of
nd weight of bricks.

properties of lime. Burning.
of Portland cement in Madras.
ment. Practical tests.

Hydraulic mortar. Mortar mix-
ortar and concrete. Plaster.

easoning, natural and artificial.
in Southern India. Strength
ound timber.

nly required). Grey and white
sts for and strength of cast
it iron in plates, bars and
Punching and drilling. Cut-
Tests for and strength of
s for, and strength of steel.
Tin. Alloys. Solder.

ts of paint. Mixing and apply-
Wood oil. Coal tar. Dis-

rubble & Ashlar and block in
laying. English and Flemish
ith offsets, between main and

ing and other works :—

nd.

will submit note books of dimen-
ed. These note books will carry

large size detail sketches, com-
de to buildings in progress, and
will be set out on the ground.
will be executed as part of the

REMARKS.

The Committee and the Principal consider that the syllabuses in Building Materials and Building Construction should be the same for the Engineer and Engineer Subordinate classes.

REMARKS.

The committee considers it inadvisable to lay down arbitrarily the quantity of work to be turned out in a given time and has assigned proper reasons for its views. The detailed list of plans and estimates has accordingly been struck out.

A revised syllabus has been drawn up for 'Surveying' almost identical with that proposed for the Engineer classes.

ving of a building.
mate.
n model. Estimate.
ification. Estimate.
. Estimate.
urements. Estimate.
on. Estimate.
actual measurements. Estimate.
cification. Estimate.

n. Estimate.
r specification. Estimate.

rs.

ts.

MARKS, 350.

apart, except during the months of owever, be sent out into camp for

s. the size of which will be regulated ery student of a squad will be told quently interchanged. The instruc- and will then leave it to its own k independently the accuracy of the actised in every detail of the work lling staves, observing, &c.

nd small italic. Construction scales. Reduction of a rectili- s. Colouring.

chain. Chaining in the field. ff-sets. Cross staff. Optical es. Station lines. Tie lines. mation of areas. Chain angles.

compasses. Measurement of gles. Field book. Plotting.

ne table and chain.

levels, and their adjustments. ook. Bench marks. Datum s sections. Corrections for ning levels for road, railway, Gradients.

hus, if
subject
to that
voted to
ving of a building.
mate.
n model. Estimat instru-
ification. Esti ain and
. Estimate. ion of a
urements. Es ojection.
on. Estimate. he plane
actual measurem d prism,
cification. Esti d cylinder
n. Estimate. om copies,
r specification. , box, &c.
for shade
walls; seg-
try, such as
rs. ors, such as
rk, such as
oth. Draw-
d preparing
k estimates.
ts. rock, and on
Arches, seg-
rils; face and
MARKS, ron combined.
apart, ex nates.
owever, Construction
rappers. Sup-
s. the si Braced girders.
ery stu
quently
and vution and regu-
k indices, canal falls,
actise luices. Drawing
lling ing.
and g. Drawing sim-
sca ley, a pulley block
is. are screw thread.
cha
ff-
es,
m

unt to be copied. Each
ry student will then draw

REMARKS.

A revised syllabus has been drawn up by Major Love with reference to the suggestions of the committee. It is almost identical with the revised syllabus for the Engineer class.

REMARKS.

uniform strength.
on beams. Strength
. Empiric formulæ for

free joints. Bracing bars
stribution of load. Equili-
rium of external forces and
nod of determining stresses.
l stress diagram. Applica-

distribution. Graphic esti-
other simple trusses. Effect
nal pressure. Distribution.
sign of timber roofs. Prin-
ansverse loads. Strength of
ly at the joints.

bridges. Difference between
Triangular frame. Graphic
s. Trapezoidal truss. Coun-
ls. Design of such frames in
llaneous structures, such as
ers.

Load. Graphic method of
aining walls. Approximate
of structures; overturning,
ine of resistance. Its position
ition. Design of walls. Con-
n having equal stability.

ENGINE.

ds, straps, belts, fast and loose
er which a given belt or rope
s. Spur wheels. Bevil and
nto circular motion and *vice*
otions. Quick return move-
Clockwork.

nd axle. Chinese windlass,
w jacks, screw presses. Crab
ck.

f Measurement.—Methods
ine and end measures. Pre-

achines.—Drilling, shaping,
s. Punching and shearing
achines.

on of the principal forms of
ruction of ordinary append-
am cylinders, slide valves,
boxes and glands, steam
cranks and crank shafts.
eam engines. Jet and sur-
ulating pump.

REMARKS.

Paragraphs (12) and (13) have been omitted as the Committee is of opinion that all references to Sanitary Engineering should be omitted from the College syllabuses.

The Committee has slightly modified the syllabus for applied mechanics. The amplification of paragraph (1) has been suggested by the Principal owing to the omission of *Statics* from the main head *Mathematics*.

uction. Body and retaining
ler sluices.
deltas and elsewhere. Sup-
of channel, limiting velocity.
drainage. Falls or drops.

nks in groups. Tanks sup-
capacity of a tank. Irrigating
revetment. Surplus weirs.

quality. Source of supply.
ar beds. Pumping. Laying

wers. Open drains. Storm
ewers.

ravity. Unit of work. Horse
n. Modulus of elasticity.
e strength. Proof and
plied load. Resistance of
ed applications of stress.

Estimation of strength of
of tension bars and their
oints in punched and drilled

on. Failure partly by crush-
odes of failure. Long bars.
of ends. Gordon's formula.
Estimation of strength of
Design of simple and com-

ders. Beams. Shearing
moment of a cross section.
g moments and shearing
formly; and in supported
ormly. Graphic represent-
scale. Resisting moment
with a thin web.

of bending and resisting
g. Estimation of strength
shearing stress. Empiric
log. Deflexion. Amount
. Formulæ for deflexion.
neous direct and tansverse

and resisting moments.
stance. Cross section of

set apart for Drawing.

reparation of working plans,
d trial pits. Equalizing cut-
om side pits. Spoil banks.
different soils. Excavation in
l formula.

Setting up cross sections.
ing out on side long ground.
nd clods. Embanking on a
nd additions. Tank bunds.

s. Horse runs. Steps and

trimming slopes of embank-
n turf or stone pitching.

ut tracer. Spirit level,
nd barrows, earth wagons,
es, crowbars.

ls. Longitudinal and cross
ent roads. Road in swampy
rk, bridges, culverts and
repairs. Hill roads, trac-
maintenance.

WORKS.*

ressure at a point and on a
mospheric pressure. Siphon.

es.—Small orifices. Velocity
on and discharge. Rectan-
elocity of approach. Sub-
ed notch.

ed weirs. Gauging weirs.
Modules.

discharge from prismatic
charge from one prismatic

y in pipes. Virtual slope.
ning full.

nels. Bazin's co-efficients.
nnels of minimum border.

of velocity and discharge.
Régime of rivers.
navigation and town
l reservoirs. Water lifts

Madras water-supply system.
ent areas will be made during
during tank basins will be per-

REMARKS.

Subsection D—Earthwork and Road—has been struck out as in the case of the revised syllabuses for the Engineer class. The Committee rightly considers that what is required can be better and more effectively learnt by students when on practical work than in the College.

Subsection E becomes C, in consequence of the omission of subsections C and D.

T.

REMARKS.

nd in circular pillars. Founda-
course. Thickness of main and
nd plugs. Openings for timber
belling. Brick-arches, flat, seg-
Centres for small arches. Bond
arches. Enclosure walls. But-
Scaffolding.
lls. Excavation. Masonry and
ight and spread of foundations.
Coffer-dams. Well foundations.
Methods of keeping wet founda-
round from working plans.
nts. Fishing and scarfing. Iron
stress in the different members.
of timber and iron combined.
es, designing and setting out.
s. Striking centres.
and floors on joists, beams and
ng of bricks, tiles, concrete and
s. Iron-tied brick arched roofs.
rs, purlins and reepers. Tiled
stone, brick, tiles, concrete and
oints and connections. Roofing
tilation of roofs.

dges.—Choice of site. Nature
urpose of bridge. Waterway.
aximum floods. Permissible
r, brick, stone, and wrought
h straight and splayed wing
eways. Spar bridges. Suspen-
s. Width of roadway. Swing

sonry. Solid, well and pile
segmental, elliptic and many-
and abutments. Skew-backs,
s. Centerings. Setting out
walls. Blocking course and
s. Oblique arches.
ts. Timber, or masonry piers.
r and iron combined.
attice frames. Superstructure.

iption only required). Founda-
nry piers, abutments and wing
nched and drilled rivet holes.
ions. Rolled beams. Simple
n web girders. Erection
r expansion.

g large size detail sketches, com-
made to bridges in progress or

will be executed as part of the

Subsection C.—Bridge construction has been omitted, as in the case of the revised syllabuses for the Engineer class, as what is required can be taught under Building materials and Building construction.

T.

MARKS, 600.

thern India. Quarrying. Blast-
Average strength and weight

Tempering. Pug mills. Hand
Drying. Burning in clamps and
Coloured bricks and tiles. Fire
Patent tiles. Characteristics of
nd weight of bricks.

properties of lime. Burning.
of Portland cement in Madras.
ment. Practical tests.

Hydraulic mortar. Mortar mix-
ortar and concrete. Plaster.

asoning, natural and artificial.
in Southern India. Strength
ound timber.

aly required). Grey and white
sts for and strength of cast
t iron in plates, bars and
Punching and drilling. Cut-
Tests for and strength of
s for, and strength of steel.
Tin. Alloys. Solder.

ts of paint. Mixing and apply-
. Wood oil. Coal tar. Dis-

ubble. Ashlar and block in
laying. English and Flemish
ith offsets, between main and

ng and other works:—

d.

will submit note books of dimen-
ed. These note books will carry

large size detail sketches, com-
de to buildings in progress, and
will be set out on the ground.
will be executed as part of the

REMARKS.

The Committee and the Principal consider that the syllabuses in Building Materials and Building Construction should be the same for the Engineer and Engineer Subordinate classes.

REVISED.

E.—MECHANISM,* AND THE STEAM ENGINE (100).

(1) **The conversion of Motion.**—Endless bands, straps, fast and loose pulleys, guide pulleys. Calculation of the amount of power capable of being transmitted by a given band or rope at a given speed. Comparison of the relative advantages of belts and ropes for transmitting power. Toothed wheels. Investigation of the forms of teeth for the transmission of motion or force in combinations of wheelwork. The rack and pinion. Spur Wheels. Bevil and Mortise wheels. The crank and connecting rod. Cams. Mangle motions, ratchet wheels, detents, escapements. Quick return movements. Linkwork and parallel motions. Peaucellier's straight line motion. Trains of wheels for screw cutting and clock-work. Epicyclic trains. Universal joints.

(2) **Work and its application to simple Machines.**—Levers, wheel and axle, pulleys, inclined plane, screw and wedge, screw jacks, screw presses, crab winches, cranes, double-geared machines and differential pulley blocks.

(3) **Friction.**—The laws of friction. Contrivances for lessening the effects of friction. Examples where friction is useful. Rolling friction. Brakes. Strap brakes. Dynamometers, and methods of measuring power. Estimation of the efficiency of machinery. Friction grips. Holding power of ropes when coiled.

(4) **True surfaces and the power of Measurement.**—Methods of measurement. Line and end measure. Rules. Callipers and guages. Preparation of a true surface and a rectangular bar. Whitworth's measuring machine.

(5) **Mechanical arrangements of Machines.**—Drilling, shaping, planing, slotting, boring and milling machines. Punching and shearing machines. Screw-cutting lathes. Weighing machines. Clocks. Watches. [Hydraulic machines.]

(6) **Generation of Steam.**—Fuels, furnaces and combustion, air required for combustion, grate and heating surface, evaporative power of fuels. Priming;—causes and remedies. Different sorts of water, and effect on evaporation. Loss of fuel by blowing out. Incrustation. Description of the principal forms of modern boilers for land, marine and locomotive engines. Strength of boilers, the use of stays; testing boilers. Details of boilers. Safety valves. Reverse or atmospheric valves, stop valves, glass water gauge. Various forms of steam pressure gauge. Feedwater heaters. Injectors and feed pumps.

* Special attention will be given to making correct hand-sketches of details of machinery.

1.

PRESI

(3) **Kinematics of Machinery.**—P
straint against sliding, turning and twi
slider crank chain, crank chains, scre
Closure of the kinematic chain. Highe
pairs by higher pairing. Higher pairin
Higher pairing of rigid elements. Roll
Cams and ratchets. The mechanics
instantaneous centre, centrode and a
compound kinematic chains.

G.—PRINCIPLES OF MECHANIS

(1) **The conversion of Motion.**—
pulleys, guide pulleys. Calculation o
being transmitted by a given band or r
of the relative advantages of belts a
Toothed wheels. Investigation of the
of motion or force in combinations of
Spur wheels. Bevil and Mortise whee
Cams. Mangle motions, ratchet wheel
turn movements. Linkwork and para
line motion. Trains of wheels for s
cyclic trains. Universal joints.

(2) **The Principle of work and**
chines.—Levers, wheel and axle, pulle
screw jacks, screw presses, crab wi
and differential pulley blocks.

(3) **Friction.**—The laws of frict
effects of friction. Examples where i
Brakes. Strap brakes. Dynamome
power. Estimation of the efficiency of
ing power of ropes when coiled.

(4) **True surfaces and the powe**
measurement. Line and end measu
Preparation of a true surface and a re
measuring machine.

(5) **Mechanical arrangements**
planing, slotting, boring and milling
machines. Screw-cutting lathes. Pr
numbering machines. Weighing machi

H.—THE STEAM ENGINE.†

(1) **History of the Steam Engin**
and Watt. Early history of marine a

(2) **Generation of Steam.**—Fuels,
for combustion, grate and heating s
Priming;—causes and remedies. Diff
evaporation. Loss of fuel by blowing
the principal forms of modern boile
engines. Strength of boilers, the use

* Special attention will be given to m
machinery.

† Lectures on the steam engine will not
the course of lectures on the theory of heat

REVISED.

(7) **The Steam Engine.**—General description of the principal forms of modern stationary steam engines. Details of the construction of the various parts, including steam cylinders, the forms of slide valve in common use, methods of balancing valves; the piston, metallic packing rings, the piston rod, stuffing boxes and glands; the steam jacket and clothing of the cylinder; the connecting rod, guide blocks and slides; crank and flywheel; the engine framing; the beam and parallel motions of beam engines. Methods of starting engines. Governors, and methods of regulating the speed of engines. Jet and surface condensers, the air pump, the hot well, force and circulating pumps. [General description of the locomotive engine and its principal details.]

(8) **The Indicator Diagram.**—Description of the Indicator, method of taking a diagram. Principal characteristics of an indicator diagram. The use of the diagram. The method of calculating the horse power of an engine from indicator diagrams.

IV.—DRAWING. MARKS, 450.

(1) **Geometrical and Perspective Drawing (60).**—Use of drawing instruments. Scales. Simple problems in practical plane geometry. Plans, elevations and sections of simple solids. [Isometric projection. Linear and angular perspective projections of geometrical solids and simple objects.]

(2) **Freehand and Model Drawing (40).**—Ornamental outlines. Application of elementary perspective to model drawing of simple objects.

(3) **Building Drawing (150).**—Tracing. Copying plans. Masonry details; bond, gauged and discharging arches, footings, foundations. Timber

PR

boilers. Safety valves. Reverse or
water gauge. Various forms of steam
Injectors and feed pumps.

(3) **The Stationary Steam En**
cipal forms of modern stationary s
tion of the various parts, including
in common use, methods of balanci
rings, the piston rod, stuffing box
clothing of the cylinder; the connect
and flywheel; the engine framing;
engines. Methods of starting engi
lating the speed of engines. Jet
the hot well, force and circulating p

(4) **Marine Engines.**—General
and triple expansion engines; ex
blocks. The propeller, various typ
propeller shaft.

(5) **The Locomotive Engine.**—
tive engine and boiler. The fire b
drical barrel; the tubes, mode of fi
the ash pit; smoke box and blast pi
steam chest, the regulator; whis
reversing or link motion, connect
side cylinders. Main frames, cra
quired for traction, adhesion of th
bearing springs, buffer and draw
continuous brakes. The tender,
method of filling the tank. Tank

(6) **The Indicator Diagram.**—
of taking a diagram. Principal
The use of the diagram. The meth
engine from indicator diagrams.

IV.—DRAWI

The course in Drawing will, as far a
while such subjects as Building constr
Applied Mechanics are being studied in
to those subjects will be executed in th
ing will be about six attendances week
making neat dimensioned detail sketch
from the first. The course as laid dow
remaining time will be devoted to Bu
Engineering Projects and Designs.

(1) **Geometrical and Perspe**
ments. Scales. Simple problem
elevations and sections of simple s
angular perspective projections of

(2) **Freehand and Model**
cation of elementary perspective t

(3) **Building Drawing.**—M
foundations, &c. Timber details

details; joints, roof frames; floors, doors and windows. Iron details; sections of cast and rolled beams; joints of iron roof frames. Small buildings. Minor bridges of timber, masonry and iron. Masonry works of irrigation.

(4) **Machine Drawing (100).**—Riveted joints, bolts, screws and keys. Screw gearing and valves. Pulleys. Spur and bevil wheels. Pipes and columns. [Cylinders]. Cast iron tanks. Details of simple machines. Making sketches from measurements. Drawing pieces of machinery from sketches.

(5) **Estimating (100).**—Simple problems in Mensuration. Taking out quantities from plans of buildings, bridges, irrigation and other masonry works. Plotting sections and estimating earthen work. Calculation of the weight of metal from plans and detailed drawings of simple machines and of structural iron work.

V.—SURVEYING. MARKS, 325. *change*

(A) Surveying (75).—Surveying with the chain, compass and plane-table. Plotting surveys.

(B) Levelling (75).—The Dumpy, Y and Reversible Levels; their adjustment and manipulation. Levelling. Contouring. Plotting.

(C) Theodolite (75).—Common and Everest [theodolites; their adjustment and manipulation. Traversing. Gale's traverse system. Setting out straight lines and curves in the field. [Triangulation.]

(D) Topographical Drawing (100).—Conventional signs. Map-drawing. Representation of ground by contours. Sections on contoured plans. Plan of road or railway on contoured ground, showing cuttings and embankments. Estimation of areas. Use of planimeter.

The whole of one day in each week will be set apart, except during the months of April and May, for field work. Students may, however, be sent out into camp for a fortnight or more at a time.

NOTE.—Students will be formed into small squads, the size of which will be regulated by the nature of the survey under execution. Every student of a squad will be told off to a particular duty, and these duties will be frequently interchanged. The instructor will show each squad how to commence work and will then leave it to its own resources, visiting it only occasionally. He will check independently the accuracy of the work performed. Each student must be fully practised in every detail of the work required in the field, such as chaining, holding levelling staves, observing, &c.

and connections. Drawing buildings buildings. Orders and styles of arc specification and actual measurement bridge. Iron roof on columns. Sma girder bridge. Irrigation works; an weir, tank sluice, with estimates of qu

(4) **Machine Drawing.**—Shaft co wheels and bevil wheels. Connecting simple machines.

(5) **Topographical Drawing.**—Sc

(6) **Applied Mechanics.**—Stress Design of timber and iron roof and b arches and masonry dams.

V.—SURVEYING

Practical Fieldwork will be carried on January to April and from August to De small squads working independently. Each particular duty, and these duties will be int will not be employed for chaining, staff holdi duties. The instructor, having seen that e leave it to its resources, carefully observing the accuracy of the work done, and its am graphical drawing, two or three attenda lectures will be delivered on the construction following course will occupy about two yea given to special surveys in connection with E

(1) **Topographical Drawing.**—Pri Colouring. Copying maps and survey of Planimeter. Plans and sections of railway on contoured ground, showing sections. Estimate of earthwork. Hill

(2) **Chain.**—Chaining in the fiel Obstacles. Chain Survey executed in of area.

(3) **Compass.**—Prismatic and Checking angles. Compass Survey of tion of compass.

(4) **Plane table.**—Plane table sur

(5) **Levelling.**—Dumpy, Y, and cross sections. Check levels. Levell less than one mile, with cross sect Plotting, and estimation of earthwork ing a hill or tank bed, by following along parallel lines. Plotting.

(6) **Theodolite.**—Common, Everes Gale's traverse system. Traverse in t filling in with compass or plane table. and distances. Setting out railway c lines and curves. Triangulation; base tions. Small triangulation in the fiel or compass.

REVISED.

VI.—LANGUAGE. MARKS, 150.

Either Tamil or Telugu will be studied, natives whose home-language is Tamil taking up Telugu, and vice versâ. *Europeans, Eurasians and natives of provinces where neither Tamil nor Telugu is ordinarily spoken may take up either language.*

(A) Conversation.—Conversation as with a maistry or ryot on ordinary District engineering topics.

(B) Written Translation.—A short piece of easy vernacular to be translated into English. English sentences (or a short piece of English) relating to the repair or construction of works to be translated into the vernacular.

REVISED.

ENGINEER SUBORDINATE CLASS.

I.—MATHEMATICS.* MARKS, 350.

A.—ALGEBRA (75).

Involution and evolution. Indices. Simple equations with one or more unknown quantities. Quadratic equations. Ratio and Proportion. Arithmetical and Geometrical Progressions.

B.—GEOMETRY (75).

Euclid, Book IV, with easy deductions, and Book VI.

C.—MENSURATION (100).

Plane and solid.

D.—PLANE TRIGONOMETRY (100).

Measurement of angles. Trigonometrical functions of an angle, and their values in special cases. Functions of the sum or difference of two angles. Logarithms, and the use of logarithmic tables. Properties of triangles. Solution of triangles. Measurement of heights and distances.

* In the course in Trigonometry, special attention will be paid to the practical solution of triangles required in Surveying. In the course in Mensuration actual measurements of models and other objects will be made.

PRESE

ENGINEER SUBORD

I.—MATHEMATICS.

A.—ARITHMETIC.

The whole subject.

B.—ALGEBRA.

The representation of unknown quantit
The use of brackets. Numerical evaluation
tion. Subtraction. Multiplication. Divi
mon factor. Lowest common multiple.
plication and division of fractions. In
Simple equations with one or more
equations.

C.—GEOMETRY.

Euclid, Books I, II, III, and IV, with

D.—PLANE TRIGONOMETRY.

Measurement of angles. Trigonometric
values in special cases. Formulæ includ
sine, cosine or tangent. Functions of the
Logarithms, and the use of logarithmic
Solution of triangles. Measurement of hei

E.—MENSURATION.

The whole subject.

F.—ELEMENTARY STATICS.

Definitions of mass and force. Measur
trical representation of forces. The para
and polygon of forces. Composition a
forces. Couples. Theory of moments.
system of forces in one plane. Centre of
efficiency of machines. The principal of
The laws of friction. Friction in connec

* In the course in Trigonometry, special
solution of triangles required in Surveying.
The course in Statics will be taught with t
will have a special bearing on Engineering pr
will be employed.

REVISED.

II.—ENGINEERING. MARKS, 1450.

A.—BUILDING MATERIALS* (50).

(1) **Stone.**—Varieties met with in Southern India. Quarrying. Blasting with powder and dynamite. Dressing. Average strength and weight of stone.

(2) **Bricks and Tiles.**—Brick earth. Tempering. Hand and machine moulding. Drying. Burning in clamps and kilns. Hoffman's kiln. Coloured bricks and tiles. Pressed bricks. Roofing, flooring and drain tiles. Fire bricks. Average strength and weight of brick. Characteristics of good bricks and tiles.

(3) **Lime, Cement, Mortar, Concrete, Plaster.**—Sources and properties of lime. Burning in intermittent and running kilns. Slaking. Mortar mixing. Fat and Hydraulic limes. Portland cement manufactured in England and in Madras. Hydraulic mortar. Surki. Concrete. Practical tests for limes and cements. Strength of mortars and concretes. Plaster and plastering. Pointing. White and colour washing.

(4) **Timber.**—Growth. Felling. Seasoning, natural and artificial. Conversion. Preservation of timber. Varieties of timber used in Southern India—teak, saul erool, karimaridoo, padowk, vengay, benteak, aynee, red and white cedar, rose-wood, casuarina, mango, palmyra, cocoanut, bamboo. Strength and weight of timber. Characteristics of good timber.

(5) **Metals.**—Iron ores. Smelting. Grey and white pig iron. Castings. Pipes and columns of cast iron. Chilled castings. Strength of cast iron. Brief description of the manufacture of wrought iron. Forms of wrought iron. Galvanized and corrugated iron. Tests and strength of wrought iron. Rivets and bolts. Punching and drilling holes. Riveting. Cutting plates and bars. Welding. Steel, hard and mild. The Bessemer process. Strength of steel. Copper. Zinc. Lead. Tin. Alloys. Soldering metals.

(6) **Paints and Varnishes.**—Ingredients of paint. Litharge. Turpentine. Linseed oil. Mixing paint. Painting old and new work. Wood oil. Coal tar. Distemper. Varnish. Papering. Putty. Glazing.

B.—BUILDING CONSTRUCTION† (100).

(1) **Masonry.**—Coursed and uncoursed rubble. Block in course. Ashlar. String courses. Copings. Bricklaying. English and Flemish bond. Bond at angles of walls, in footings with offsets, between main and

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* During this course, visits of inspection will be made to the following and other works :—

(*a*) Pallávaram stone quarries.
(*b*) Perambúr brickfields.
(*c*) Government brickfield, Poonamallee Road.
(*d*) Lime-kilns, Cochrane's basin.
(*e*) Madras cement works.
(*f*) Gun Carriage Factory or other foundry.

Written reports are not required, but students will submit note books of dimensioned sketches illustrative of the processes witnessed.

† Great stress will be laid on the importance of making large size detail sketches, completely dimensioned. Visits of inspection will be made to buildings in progress, and note books of sketches will be submitted. Buildings will be set out on the ground.

In connection with this subject, Building drawings will be executed as part of the Drawing course—*vide III. Drawing.*

PRESE

II.—ENGINEERIN

A.—BUILDING MATERIALS.*

(1) **Stone.**—Varieties met with in ing with powder and dynamite. Dress of stone.

(2) **Bricks and Tiles.**—Brick earth and machine, ground and table moulding kilns. Hoffman's kiln. Pressed bricks bricks. Roofing, flooring and drain tiles good bricks and tiles. Average strength

(3) **Limes and Cements.**—Sources Slaking. Varieties of lime. Manufact Properties of Portland cement. Roman

(4) **Mortar, Concrete and Plaster.** ing. Surki. Concrete. Strength of Pointing. White and colour washing.

(5) **Timber.**—Growth and felling. Conversion. Preservation. Varieties and weight of timber. Characteristics of

(6) **Metals.**—(Brief general descript pig iron. Castings. Pipes and colum iron. Wrought iron manufacture. V sheets. Galvanised iron. Rivets and b ting plates and bars. Riveting. Wel wrought iron. Steel, hard and mild. Tempering of steel. Copper. Zinc. L

(7) **Paints and Varnishes.**—Ingred ing. Painting old and new work. P temper. Varnish. Papering. Glazing

B.—BUILDING CONSTRUCTION.†

(1) **Masonry.**—Coursed and uncou course. String courses and copings. I bond. Bond at angles of walls, in footi

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* Visits of inspection will be made to the
(*a*) Pallávaram stone quarries.
(*b*) Perambúr brickfields.
(*c*) Government brickfield, Poonamal
(*d*) Lime-kilns, Cockrane's basin.
(*e*) Madras cement works.
(*f*) Gun Carriage Factory or other fo

Written reports are not required, but stu sioned sketches illustrative of the processes marks.

† Great stress is laid on the importance of pletely dimensioned. Visits of inspection wi note books of sketches will be submitted. A

In connection with this subject, Building Drawing course.

REVISED.

cross walls, at door and window openings and in circular pillars. Foundations and footings. Plinth. Damp proof course. Thickness of main and cross walls. Wall plates. Wood bricks and plugs. Openings for timber beams, for doors and windows. Corbelling. Flat, segmental, pointed and relieving brick arches. Inverts. Centres for small arches. Bond in brick and stone arches. Small oblique arches. Enclosure walls. Buttresses and counterforts. Retaining and breast walls. Scaffolding.

(2) **Foundations.**—Excavation. Masonry and concrete foundations. Unequal settlement. Pressure on soil under foundations. Foundations on rock, good and bad soils. Piles. Coffer dams and caissons. Well foundations. Brick and iron wells. Mode of sinking wells. Patent excavators for well sinking. Setting out buildings from working plans.

(3) **Carpentry.**—Mortise and tenon joint. Fishing and scarfing. Iron straps and bolts. Roof and bridge frames, nature of stress in the different members. Detail of joints. Frames of timber and iron combined. Trussed beams. Timber floors. Stairs, designing and setting out. Doors and windows. Centerings for arches. Striking centres.

(4) **Roofs and Floors.**—Terrace roofs and floors on joists, beams and joists, or iron girders and joists. Bengal terrace roofs. Fire-proof floors. Brick arched roofs. Pitched roofs. Couples. Trusses. Rafters, purlins and reepers. Roof coverings of thatch, tiles, slates and shingles. Ceilings. Floors of stone, brick, tiles, concrete, timber and asphalte. Simple forms of iron roof. Use of tee, angle and channel iron in compression, and of rods and flat bars in tension. Joints and connections. Shoes, rivets, bolts. Iron and timber purlins. Brackets. Patent tiles, corrugated iron, lead and zinc roofing. Modes of attachment. Ventilators.

(5) **Bridges.**—Names of parts. Thickness of arch-ring, wing-walls, centerings. Setting out arches full size.

(6) **Roads.**—Road construction and maintenance.

PRES

cross walls, at door and window openings
tions and footings. Plinth. Damp pro
cross walls. Wall plates. Wood bricks
beams. Door and window openings. C
mental, pointed and relieving. Inver
in brick and stone arches. Small obli
tresses and counterforts. Retaining w

(2) **Foundations.**—Foundations fo
concrete foundations. Benching out.
Foundations in wet and soft soils. Pile
Sinking wells. Excavators. Iron wells
tions dry. Setting out buildings on the

(3) **Carpentry.**—Mortise and tenon
straps and bolts. Roof frames, nature
Detail of joints of roof trusses. Fra
Trussed beams. Timber floors. Stair
Doors and windows. Centerings for ar

(4) **Roofs and Floors.**—Terrace ro
joists, or iron girders and joists. Co
plaster. Bengal terrace. Fire-proof fl
Pitched roofs. Couples. Trusses. Ra
and thatched roofs. Ceilings. Floors
asphalte. Simple forms of iron roofs.
with patent tiles and corrugated iron.

C.—BRIDGE CONSTRUCTION.*

(5) **Site, Waterway and Design**
of stream or river, and its bed and ban
Estimation of velocity and discharge
velocity. Afflux. Choice of material;
iron. Setting out bridges on the grou
walls.

(6) **Temporary Bridges.**—Paved
sion bridges. Bridges of boats and pon
openings.

(7) **Masonry Bridges.**—Strength
foundations. Flooring of bridges. A
centered. Setting out arches full size.
cut-waters, wing-walls, thickness of arc
courses on centres. Bond. Spandrils.
parapets. Roadway. Drainage. App

(8) **Timber Bridges.**—Masonry a
Crib-work piers. Frames of timber, o
Abutting frames. Trapezoidal trus
Arched ribs of planks.

(9) **Iron Bridges.**—(Brief general
tions, solid, well and iron cylinders.
walls. Forms of iron used for bridges
Chain and lozenge riveting. Pin co
plate girder bridges with parallel fla
of girders. Support of ends, and allow

* Great stress is laid on the importance o
pletely dimensioned. Visits of inspection
completed; and a bridge will be set out on t
In connection with this subject, Bridge
Drawing course.

C.—HYDRAULICS AND IRRIGATION WORKS* (100).

(1) **Hydrostatics.**—Hydrostatic laws. Pressure at a point and on a surface. Equal transmission of pressure. Atmospheric pressure. Siphon. Specific gravity. Flotation.

(2) **Discharge from Orifices and Notches.**—Small orifices. Velocity of discharge. Co-efficients of velocity, contraction and discharge. Rectangular orifice and notch. Triangular notch. Velocity of approach. Submerged and partly submerged orifices. Submerged notch.

(3) **Practical Cases.**—Tank weirs. Drowned weirs. Gauging weirs. Anicuts. Sluices; head, under, lock and tank. Modules.

(4) **Discharge under variable head.**—Free discharge from prismatic vessels. Time of emptying or filling locks. Discharge from one prismatic vessel into another.

(5) **Flow in Pipes.**—Fluid friction. Velocity in pipes. Virtual slope. Discharge. Inclination of pipes. Pipes not running full.

(6) **Flow in Channels.**—Sections for channels. Bazin's co-efficients. Discharge of channels. Practical data. Channels of minimum border. Falls.

(7) **Rivers.**—Cross sections. Measurement of velocity and discharge. Flood discharge from catchment basins. Bends. Régime of rivers.

(8) **Storage and Distribution.**—Irrigation, navigation and town supply. Rainfall. Supply from wells, rivers and reservoirs. Water lifts and pumps.

* Inspection will be made of the Redhills tank, and Madras water-supply system. Drawings of Irrigation works and estimation of catchment areas will be made during the Drawing course. Levelling for channels and contouring tank basins will be performed during the Surveying course.

D.—EARTHWORK AND ROADS.

(1) **Preliminary.**—Selection of line. longitudinal and cross sections. Boring tings and embankments. Embankment Practical stability of earth. Side slopes rock. Calculations of earthwork. Prism

(2) **Setting Out.**—Marking centre li Allowance for settlement and shrinkage.

(3) **Embankments.**—Breaking lumps slope. Punning or ramming. Repairs Puddle walls.

(4) **Cuttings.**—Staging and plank ramps.

(5) **Slopes and Drainage.**—Dressing ments and cuttings. Protection of slopes

(6) **Tools and Plant.**—Clinometer. Mason's level. Boning rods. Wheel and baskets, mamoties, pickaxes, shovels and sp

(7) **Roads.**—Direction. Survey and l sections. Drainage. Fair weather and per ground. Trunk and ordinary roads. drains. Metalling. Rollers. Maintenan ing and execution, drainage, retaining wa

E.—HYDRAULICS AND IRRIGATI

(1) **Hydrostatics.**—Hydrostatic laws. surface. Equal transmission of pressure. Specific gravity. Flotation.

(2) **Discharge from Orifices and No** of discharge. Co-efficients of velocity, con gular orifice and notch. Triangular notc merged and partly submerged orifices. S

(3) **Practical Cases.**—Tank weirs. A nicuts. Sluices; head, under, lock and

(4) **Discharge under variable head** vessels. Time of emptying or filling lock vessel into another.

(5) **Flow in Pipes.**—Fluid friction. Discharge. Inclination of pipes. Pipes

(6) **Flow in Channels.**—Sections f Discharge of channels. Practical data. Falls.

(7) **Rivers.**—Cross sections. Measur Flood discharge from catchment basins.

(8) **Storage and Distribution.**—Irri supply. Rainfall. Supply from wells, r and pumps.

* Inspection will be made of the Redhills Drawings of Irrigation works and estimation o the Drawing course. Levelling for channels formed during the Surveying course.

(9) **Anicuts.**—Types, and details of construction. Body and retaining walls. Aprons. Wing walls. Head and under sluices.

(10) **Canals and Channels.**—Irrigation in deltas and elsewhere. Supply from rivers. Storage in tanks. Capacity of channel, limiting velocity. Surface fall, side slopes, alignment. Cross drainage. Falls or drops. Navigation canals. Locks.

(11) **Tanks.**—Isolated rain-fed tanks. Tanks in groups. Tanks supplied from rivers or streams. Catchment and capacity of a tank. Irrigating duty of water. Tank bunds, puddle walls, revetment. Surplus weirs. Tank sluices. Closing breaches.

D.—APPLIED MECHANICS* (125).

(1) **Preliminary.**—Parallelogram, triangle and polygon of forces; parallel forces; moments; centre of gravity; specific gravity; energy; unit of work; horse power. Dead and live loads; stress and strain; modulus of elasticity; Hooke's law; factor of safety; resistance of building materials to stress.

(2) **Tension.**—Stress in a cross section. Tension bars and their joints in timber and wrought iron. Riveted joints.

(3) **Compression.**—Stress in a cross section. Failure partly by crushing and partly by bending. Short bars. Modes of failure. Long bars. Strength dependent on mode of attachment of ends. Gordon's formula. Hodgkinson's formulæ for bars of cast iron. Estimation of strength of struts in timber, cast iron, and wrought iron.

(4) **Transverse Stress.**—Cantilevers. Girders. Beams. Shearing stress. Bending moment in a beam. Resisting moment of a cross section. General equations of transverse stress. Bending moments and shearing stresses in cantilevers, loaded at end, and uniformly; and in supported beams, loaded at middle, at any point, and uniformly. Graphic representation of bending moment and shearing stress, to scale. Resisting moment of a rectangular section, and of a flanged section with a thin web.

(5) **Solid Rectangular Beams.**—Equation of bending and resisting moments. Modulus of rupture by cross breaking. Estimation of strength of timber beams. Their design. Neglect of shearing stress. Empiric formulæ. Strongest beam from a cylindric log. Deflexion. Amount allowable. Formulæ for deflexion. Stiffest beam from a cylindric log. Simultaneous direct and transverse loading. Design of beams so loaded.

(6) **Flanged Beams.**—Equation of bending and resisting moments. Equation of shearing stress and shearing resistance. Strength and design

* Stress diagrams will be drawn during the hours set apart for Drawing.

(9) **Anicuts.**—Types, and details of co
walls. Aprons. Wing walls. Head and

(10) **Canals and Channels.**—Irrigatio
ply from rivers. Storage in tanks. Cap
Surface fall, side slopes, alignment. C
Navigation canals. Locks.

(11) **Tanks.**—Isolated rain-fed tanks.
plied from rivers or streams. Catchment
duty of water. Tank bunds, puddle wa
Tank sluices. Closing breaches.

(12) **Supply of Towns.**—Quantity an
Wells. Main and service reservoirs.
pipes.

(13) **Town Drainage.**—Sewage and
water. Disposal of sewage. Ventilation

F.—APPLIED MECHANICS.*

(1) **Preliminary.**—Specific gravity.
power. Load, dead and live. Stress and
Hooke's law. Modulus of rupture. U
working load. Factor of safety. Sudden
building materials to stress. Effect of
Fatigue in materials.

(2) **Tension.**—Stress in a cross sec
timber and iron tension bars, ropes, &c.
joints in timber and wrought iron. Rivet
plates.

(3) **Compression.**—Stress in a cross s
ing and partly by bending. Short bars.
Strength dependent on mode of attachm
Hodgkinson's formulæ for bars of cast
struts in timber, cast iron, and wrought i
pound struts.

(4) **Transverse Stress.**—Cantilevers
stress. Bending moment in a beam. R
General equations of transverse stress.
stresses in cantilevers, loaded at end, a
beams, loaded at middle, at any point, an
ation of bending moment and shearing st
of a rectangular section, and of a flanged

(5) **Solid Rectangular Beams.**—E
moments. Modulus of rupture by cross
of timber beams. Their design. Negle
formulæ. Strongest beam from a cy
allowable. Modulus of deflexional ela
Stiffest beam from a cylindric log. S
loading. Design of beams so loaded.

(6) **Flanged Beams.**—Equation of
Equation of shearing stress and sheari

* Stress diagrams will be drawn during

of small cast iron beams. Strength and design of small plate girders. Rolled beams. Formulæ for strength of rolled beams.

(7) **Framed Structures.**—Perfectly and imperfectly braced frames. Distribution of load. Graphic method of determining stresses. Frame diagram. Stress diagram. Reciprocal stress diagram. Application to a triangular frame. Bow's lettering.

(8) **Roofs.**—Vertical load on roofs. Graphic estimation of stresses in simple trusses. Effect of wind on roofs. Graphic estimation of stress due to wind. Design of timber roofs. Strength of joints. Design of small iron trusses loaded only at the joints.

(9) **Framed Bridges, &c.**—Simple road bridges. Dead and live loads. Triangular frame. Graphic method of determining stresses. Bollman truss. Trapezoidal truss. Counterbracing. Design of simple frames in timber, or timber and iron combined. Miscellaneous structures, such as jib crane, derrick crane, sheers, braced cantilevers.

(10) **Masonry Structures.**—Composition. Load. Graphic method of determining pressure of water or earth on retaining walls. Approximate rules for thrust of arches. Modes of failure of structures; overturning, crushing, sliding. Conditions of stability. Line of resistance. Graphic determination of its position. Design of walls.

E.—MECHANISM AND THE STEAM ENGINE (75).

(1) **Conversion of Motion.**—Endless bands, straps, belts, fast and loose pulleys, guide pulleys. Calculation of the power which a given belt or rope can transmit at a given speed. Toothed wheels. Spur wheels. Bevil and mortise wheels. Conversion of reciprocating into circular motion and *vice versâ*. Rack and pinion. Cams. Mangle motions. Quick return movements. Trains of wheels for screw-cutting. Clock work.

(2) **Principle of Work.**—Levers, wheel and axle. Chinese windlass, pulleys, inclined planes, screw and wedge, screw jacks, screw presses. Crab winches. Cranes. The differential pulley block.

(3) **True Surfaces and the Power of Measurement.**—Methods of measuremet. Rules, callipers, gauges. Line and end measures. Preparation of true surfaces and rectangular bars.

(4) **Mechanical arrangements of Machines.**—Drilling, shaping, planing, slotting, boring and milling machines. Punching and shearing machines. Screw-cutting lathes. Weighing machines.

(5) **The Steam Engine.**—General description of the principal forms of stationary engines and boilers. Details of construction of ordinary appendages to boilers. Details of construction of steam cylinders, slide valves, pistons, piston rods and cross heads, stuffing boxes and glands, steam jackets and cylinder lagging, connecting rods, cranks and crank shafts. Engine frames, beams and parallel motion of beam engines. Jet and surface condensers, the air pump, hot well and circulating pump.

uniform strength for cast and wrough
Uniform beams. Strength and design
and design of small plate girders. R
strength of rolled beams.

(7) **Framed Structures.**—Assump
Perfectly and imperfectly braced fra
brium of external forces on structure.
internal stresses at each joint. Grap
Frame diagram. Stress diagram. R
tion to a triangular frame. Bow's lette

(8) **Roofs.**—Vertical load on roofs
mation of stresses in king rod, queen r
of wind on roofs. Amount of maxim
Graphic estimation of stress due to win
cipal rafters bearing direct, or direct
joints. Design of small iron trusses loa

(9) **Framed Bridges, &c.**—Simple
roof and bridge frames. Dead and live l
method. Abutting structures. Bollma
terbracing. Simple frames with parallel
timber, or timber and iron combined.
jib crane, derrick crane, sheers, braced

(10) **Masonry Structures.**—Com
determining pressure of water or earth
rules for thrust of arches. Modes of
crushing, sliding. Conditions of stabili
for safety. Graphic determination of it
version of rectangular into trapezoidal s

G.—MECHANISM AND THE STE

(1) **Conversion of Motion.**—Endles
pulleys, guide pulleys. Calculation of t
can transmit at a given speed. Toothed
mortise wheels. Conversion of recipro
versâ. Rack and pinion. Cams. Man
ments. Trains of wheels for screw-cutt

(2) **Principle of Work.**—Levers, w
pulleys, inclined planes, screw and wed
winches. Cranes. The differential pu

(3) **True Surfaces and the Po**
of measurement. Rules, callipers, gau
paration of true surfaces and rectangul

(4) **Mechanical arrangements**
planing, slotting, boring and milling
machines. Screw-cutting lathes. Wei

(5) **The Steam Engine.**—General
stationary engines and boilers. Details
ages to boilers. Details of construction
pistons, piston rods and cross heads,
jackets and cylinder lagging, connecti
Engine frames, beams and parallel mot
face condensers, the air pump, hot well

REVISED.

III.—DRAWING. MARKS, 325.

A. Geometric and Perspective Drawing (40).—Use of drawing instruments. Scales. Simple problems in practical plane geometry. Plans, elevations and sections of simple solids. Isometric projection. Linear and angular perspective projections of geometrical solids and simple objects.

B. Freehand and Model-drawing (35).—Ornamental outlines. Application of elementary perspective to model-drawing of simple objects.

C. Building Drawing (100).—Tracing. Copying plans. Masonry details; bond, gauged and discharging arches, footings and foundations. Timber details; joints, roof-frames, floors, doors and windows. Iron details; sections of cast and rolled beams; joints of iron roof frames. Small buildings. Minor bridges of timber, masonry and iron. Masonry works of irrigation.

D. Machine Drawing (75).—Riveted joints, bolts, screws, and keys. Screw-gearing and valves. Pulleys. Spur and bevil wheels. Pipes and columns. Cast iron tanks. Details of simple machines.

E. Estimating (75).—Simple problems in mensuration. Taking out quantities from plans of buildings, bridges, irrigation and other masonry works. Plotting sections and estimating earthwork.

PREV

III.—DRAWIN

This course will be worked in connec
Building construction or Bridges, or Applie
under consideration in the Engineering co
subject will, as far as possible, be executed
Drawing.

I. Practical Plane and Solid
ments. Simple problems on straigh
diagonal scales. Simple problems o
rectilineal figure to a triangle. Parab
Representation of a point in space in a
of projection. Plans and elevations
placed in any position. Plans and ele
in any position. Sections of the above

II. Free-hand and Model-drawin
drawing geometrical solids, and simp
Application of elementary perspective

III. Buildings.—Conventional co
lines and shadows. Details of mason
mental, pointed, flat, and relieving arc
joints, roof-frames, doors, staircases.
terracing, roof-covering; fire-proof fl
rolled beams, cast iron columns, iron-
ing buildings from specification.
detail and abstract estimates of quanti

IV. Bridges.—*Masonry Bridges.*—
wells. Construction of piers, abutm
mental, elliptic and many-centered.
parapet walls. Drawing from specific
Timber Bridges.—Frames of timb
Joints, superstructure. Drawing from
Iron Bridges.—Wrought iron plat
of plate girders; flanges, web, angles
port of ends. Main and cross girde
Drawing from models or actual measu

V. Irrigation Works.—Nature o
lating works of an irrigation system
locks, inlets and outlets, tank escape
irrigation works from models and spe

VI. Machinery.—Conventional s
ple pieces of machinery from model
and chain, a plummer block, a tooth

PLANS AND
to be prepared d
Practical Plane Geometry, five s
Practical Solid Geometry, three

* The problems in Geometrical Draw
construction will be demonstrated on the b
the figure in his own way.

IV.—SURVEYING. MARKS, 275.

A. Surveying (75).—Surveying with chain, compass and plane table. Plotting surveys.

B. Levelling (75).—The Dumpy, Y, and reversible levels; their adjustment and manipulations. Levelling. Contouring. Plotting.

C. Theodolite (50).—Common and Everest theodolites; their adjustment and manipulation. Traversing. Gale's traverse system. Setting out straight lines and curves in the field.

D. Topographical Drawing (75).—Conventional signs, map-drawing. Representation of ground by contours. Sections on contoured plans. Plan of road or railway on contoured ground showing cuttings and embankments. Estimation of areas.

The whole of one day in each week will be set apart, except during the months of April and May, for field work. Students may, however, be sent out into camp for a fortnight or more at a time.

NOTE.—Students will be formed into small squads, the size of which will be regulated by the nature of the survey under execution. Every student of a squad will be told off to a particular duty, and these duties will be frequently interchanged. The instructor will show each squad how to commence work and will then leave it to its own resources, visiting it only occasionally. He will check independently the accuracy of the work performed. Each student must be fully practised in every detail of the work required in the field, such as chaining, holding levelling staves, observing, &c.

Masonry details.
Timber details.
Iron-roof details.
Tracing on cloth, and colouring a
Small building with couple roof.
Building with terrace-roof, drawn
Building with pent roof, drawn fr
Masonry bridge, drawn from speci
Masonry bridge, drawn from actua
Timber bridge, drawn from specifi
Iron plate girder bridge, from mode
Head sluice, drawn from model or
Canal lock, from model. Estimat
Tank escape, from model or specifi
Tank distribution sluice, from mod
Free-hand drawing, two sheets.
Perspective drawing, three sheets.
Model-drawing, five sheets.
Rivets and riveted joints.
Bolts and nuts, screws, keys and c
Shaft couplings and pulleys.
Shaft pedestal.
Spur wheel.
Bevil wheel.
Simple machine, drawn from mea

IV.—SURVEYIN

The whole of one day in each week will
April and May, for field work. Students
a fortnight at a time.

NOTE.—Students will be formed into sma
by the nature of the survey under executio
off to a particular duty, and these duties will
tor will show each squad how to commenc
resources, visiting it only occasionally. He
work performed. Each student must be f
required in the field, such as chaining, holdi

1. **Drawing.**—Printing in plain
and use of plain, comparative, and v
neal figure to a triangle. Convention

2. **Chain.**—Structure and use o
Incorrect chain. Chaining on a sl
square. Obstacles. Ill-conditioned i
Hand sketch. Field book. Plotting
Heights and distances without instru

3. **Compass.**—Prismatic and sur
horizontal angles. Traversing. Che
Variation of compass.

4. **Plane Table.**—Surveying with

5. **Levelling.**—Dumpy, Y, and re
Levelling staves. Use of the level.
line. Check levels. Longitudinal
curvature and refraction. Water lev
or channel. Centre line. Formatio

REVISED.

V.—LANGUAGE. MARKS, 125.

Either Tamil or Telugu will be studied, natives whose home-language is Tamil, taking up Telugu and vice versâ. Europeans, Eurasians and natives of provinces where neither Tamil nor Telugu is ordinarily spoken may take up either language.

(A). Conversation.—Conversation as with a maistry or ryot on ordinary district engineering topics.

(B). Written Translation.—A short piece of easy vernacular to be translated into English. English sentences (or a short piece of English) relating to the repair or construction of works to be translated into the vernacular.

6. **Theodolite.**—Common or c
Adjustment. Measurement of ho
of heights and distances.

7. **Traversing.**—Traversing v
Use of traverse tables. Interior fi

8. **Contouring.**—Nature of co
such as the sides of a railway cut
level: (1) by following successive
lines.

9. **Curves.**—Radius. Tangent
chords and offsets; (2) by angles

PLANS

to be executed

Printing.
Scales.
Chain Survey of about 30 acres
lines only to be plotted. Estimatio
Plan of country, introducing co
Chain survey of about 60 ac
and coloured. Field book.
Chain and compass survey of
showing details. Estimation of a
Copying a survey to a changed
Plane table survey of about 50
Tracing a survey on cloth, and
Line of levels, half mile long, w
the field, and plotted. Field book
Line of levels, one mile long, v
road, railway or channel, showing
Line of levels along a bank, no
sections every 660 feet.
Line of levels one mile long ab
not less than three in number for a
Traverse with the theodolite of a
filled in, half with compass and hal
Plate of heights and distances
with and without instruments.
Contour plate of hilly ground
the level in the field. Section on
Hill shading a plate of contou
Curve plate. Plotting curves

REVISED.

SUB-OVERSEER AND SURVEYOR CLASS.

I.—SURVEYING. MARKS, 400.

A. Surveying (100).—Surveying with chain, compass and plane table. Plotting surveys.

B. Levelling (100).—The Dumpy, Y, and reversible levels; their adjustment and manipulation. Levelling. Contouring. Plotting.

C. Theodolite (100).—Common and Everest theodolites; their adjustment and manipulation. Traversing. Gale's traverse system. Setting out straight lines and curves in the field.

D. Topographical Drawing (100).—Conventional signs, map-drawing. Representation of ground by contours. Sections on contoured plans. Plan of road or railway on contoured ground, showing cuttings and embankments. Estimate of areas.

The whole of one day in each week will be set apart, except during the months of April and May, for field work. Students may, however, be sent out into camp for a fortnight or more at a time.

NOTE.—Students will be formed into small squads, the size of which will be regulated by the nature of the survey under execution. Every student of a squad will be told off to a particular duty, and these duties will be frequently interchanged. The instructor will show each squad how to commence work and will then leave it to its own resources, visiting it only occasionally. He will check independently the accuracy of the work performed. Each student must be fully practised in every detail of the work required in the field, such as chaining, holding levelling staves, observing, &c.

II.—ENGINEERING. MARKS, 225.

A.—BUILDING MATERIALS* (75).

(1) **Stone.**—Varieties met with in Southern India. Quarrying. Blasting with powder and dynamite. Dressing.

(2) **Bricks and Tiles.**—Brick earth. Tempering. Hand and machine moulding. Drying. Burning in clamps and kilns. Hoffman's kiln. Pressed bricks. Tiles. Average strength and weight of brick. Characteristics of good bricks and tiles.

(3) **Lime, Cement, Mortar, Concrete, Plaster.**—Sources and properties of lime. Burning in intermittent and running kilns. Slaking. Mortar mixing. Fat and hydraulic limes. Portland cement. Hydraulic mortar. Surki. Concrete. Practical tests for limes and cements. Plaster and plastering. Pointing. White and colour washing.

* During this course, visits of inspection will be made to the following and other works:—

(*a*) Pallávaram stone quarries.
(*b*) Perambúr brickfields.
(*c*) Government brickfield, Poonamallee Road.
(*d*) Lime-kilns, Cochrane's Basin.
(*e*) Madras cement works.
(*f*) Gun Carriage Factory, or other foundry.

Written reports are not required, but students will submit note books of dimensioned sketches illustrative of the processes witnessed.

PRESI

SYLLA

SURVEYOR

The object of the course is to make each view each division of the class will be sub-di pendently of one another. Each squad will c capable of working the survey. The students day or oftener, so that each may be exercised chaining, taking offsets, or marking points.

The instructor, having fairly started the resources. He will visit each squad however proper amount of work is being executed. observation keep a careful check on the *accu* work must always be re-surveyed. Each of t two full days a week in field work except durin

1. **Mensuration.**—*Lengths*—Right Circumference of circle. Arc of circle. *Areas*—Rectangle. Parallelogram. T polygons. Similar figures. Circle. Si

2. **Drawing.**—Use of drawing instr ple problems in geometrical drawing, st cular, or parallel, or at a given inclinati line in a given proportion, or into any n a given rectilineal figure to a triangle. tion of plain, comparative, and vernier sc on cloth. Copying to changed scale. meter.

3. **Chain.**—Structure and use of the on a slope. Checking distances. Offs Obstacles. Ill-conditioned triangles. Heights and distances without instrume

4. **Compass.**—Prismatic and surve horizontal angles. Traversing. Checki and protracting. Variation of compass.

5. **Plane Table.**—Surveying with p

6. **Levelling.**—Dumpy and Y level staves. Use of the level. Field bo Checking levels. Longitudinal and cr ture and refraction. Cushing's reversi levels. Running levels for road, railwa tion level. Gradients.

7. **Contouring.**—Nature of conto slopes, as the sides of a railway cuttin the level (1) by following successive co lines. Drawing sections on contoured

8. **Hill-shading.**—Scale of shade. with horizontal hachures.

9. **Trigonometry.**—Trigonometrica tables. Solution of triangles.

(4) **Timber.**—Seasoning, natural and artificial. Conversion. Preservation of timber. Varieties of timber used in Southern India. Strength and weight of timber. Characteristics of good timber.

(5) **Paints and Varnishes.**—Ingredients of paint, litharge, turpentine, linseed oil. Mixing paint. Painting old and new work. Wood oil. Coal tar. Varnish. Putty. Glazing.

150

B.—BUILDING CONSTRUCTION* (200).

(1) **Masonry.**—Coursed and uncoursed rubble. Block in course. Ashlar. String courses. Copings. Bricklaying. English and Flemish bond. Bond at angles of walls, in footings with offsets, between main and cross walls, at door and window openings and in circular pillars. Foundations and footings. Plinth. Thickness of main and cross walls. Wall plates. Wood bricks and plugs. Openings for timber beams, for doors and windows. Corbelling. Flat, segmental, pointed and relieving brick arches. Centres for small arches. Bond in arches. Small oblique arches.

(2) **Foundations.**—Excavation. Masonry and concrete foundations. Unequal settlement. Foundations on rock, good and bad soils. Well foundations. Setting out buildings from working plans.

(3) **Carpentry.**—Morties and tenon joint. Fishing and scarfing. Iron straps and bolts. Simple roof and bridge frames. Detail of joints. Frames of timber and iron combined. Doors and windows.

(4) **Roofs and Floors.**—Terrace roofs and floors on joists, beams and joists, or iron girders and joists. Bengal terrace roofs. Pitched roofs. Couples. Trusses. Rafters, purlins and reepers. Roof covering. Ceilings. Floors of stone, brick, tiles, concrete, timber and asphalte. Simple forms of iron roofs. Joints and connections. Iron and timber purlins. Ventilators.

(5) **Bridges.**—Names of parts. Thickness of arch ring, wing walls, centerings. Setting out arches full size.

(6) **Roads.**—Road construction and maintenance.

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*Great stress will be laid on the importance of making large size detail sketches, completely dimensioned. Visits of inspection will be made to buildings in progress, and note books of sketches will be submitted. Buildings will be set out on the ground.
In connection with this subject, Building drawings will be executed as part of the Drawing course.

10. **Box Sextant.**—Use of box sex angles to a horizontal plane. Measu Interpolation.

11. **Theodolite.**—Common or ordi lite. Measurement of horizontal and v

12. **Traversing.**—Traversing with system. Use of traverse tables. Inter table.

13. **Curves.**—Radius. Tangent po chords and offsets, (2) by angles at the

14. **Triangulation.**—Measurement conditioned triangles. Calculation of Satellite stations. Plotting and protrac

SURVEYS AN

to be prepared dur

NOTE.—The surveys need not be made in whole of them must be executed during the co

First ye

Printing, Geometrical Drawing, Sc
Chain survey of about 5 acres, exec lines only to be plotted. Area to be e
Conventional signs, in ink only.
Plan of country introducing convent
Chain survey of about 20 acres, exec To be plotted and coloured. Field book
Survey plan to be traced on cloth, a
Survey plan to be copied to a chang
Chain and compass survey of abo Boundary to be traversed and plotted, a
Chain and compass survey of about with plane table in the field. Fair cop book.
Plane table survey of about one sq fair copied.
Circuit of levels run in the field a flying levels.

Second

Line of levels, half mile long, with the field, on the chain and compass s sheet. Field book.
Line of levels along a tank bund, at every 660 feet. Field book.
Line of levels along a canal or rive not less than three in number for a riv
Line of levels, one mile long, with the field for a road, railway or channe Field book.
Heights and distances from measu

III.—DRAWING. MARKS, ~~500~~ 375

A. Geometrical Drawing (~~100~~ 75).—Use of drawing instruments, scales, simple problems in practical plane geometry. Plans, elevations, and sections of simple solids.

B. Building Drawing (~~200~~ 150).—Tracing. Copying plans. Masonry details; bond, gauged and discharging arches, footings and foundations. Timber details; joints, roof frames, floors, doors and windows. Iron details; sections of cast and rolled beams; joints of iron roof frames. Small buildings. Minor bridges of timber, masonry and iron. Masonry works of irrigation.

C. Estimating (~~200~~ 150).—Simple problems in Mensuration. Taking out quantities from plans of buildings, bridges, irrigation and other masonry works. Plotting sections and estimating earthwork.

Traverse with theodolite of about 150 acre
filled in half with compass and half with plane
* Contouring with the level a piece of hill
plotted, and section and elevations and drawn.
Contouring a tank bed by parallel lines,
book. Plotting.
Shading a contoured plan with pen.
Shading a contoured plan with brush.
Plotting curves from measurements made in
* Triangulation of from 5 to 10 square miles,
ment and reduction of base. Calculation of si
Interior filling in as time permits.

* These surveys will be executed if possible

REVISED.

DRAFTSMAN CLASS.

A. Geometrical and Perspective Drawing (75).—Use of drawing instruments. Scales. Simple problems in practical plane geometry. Plans, elevations and sections of simple solids. Isometric projection. Linear and angular perspective projections of geometrical solids and simple objects.

B. Free-hand and Model Drawing (75).—Ornamental outlines. Application of elementary perspective to model drawing of simple objects.

C. Building Construction and Drawing (400).—

(1) Building Construction (125).—

(1) **Masonry.**—Coursed and uncoursed rubble. Block in course. Ashlar. String courses. Copings. Bricklaying. English and Flemish bond. Bond at angles of walls, in footings with offsets, between main and cross walls, at door and window openings and in circular pillars. Foundations and footings. Plinth. Thickness of main and cross walls. Wall plates. Wood bricks and plugs. Openings for timber beams, for doors and windows. Corbelling. Flat, segmental, pointed and relieving brick arches. Centres for small arches. Bond in arches.

(2) **Foundations.**—Excavation. Masonry and concrete foundations. Foundations on rock, good and bad soils. Well foundations.

(3) **Carpentry.**—Mortise and tenon joint. Fishing and scarfing. Iron straps and bolts. Simple roof and bridge frames. Detail of joints. Frames of timber and iron combined. Doors and windows.

(4) **Roofs and Floors.**—Terrace roofs and floors on joists, beams and joists, or iron girders and joists. Bengal terrace roofs. Pitched roofs. Couples. Trusses. Rafters, purlins and reepers. Roof covering. Floors of stone, brick, tiles, concrete, timber and asphalte. Simple forms of iron roofs. Joints and connections. Iron and timber purlins. Ventilators.

(5) **Bridges.**—Names of parts. Arch ring. Wing walls.

(2) Building Drawing (275).—Tracing. Copying plans. Masonry details: bond, gauged and discharging arches, footings and foundations. Timber details: joints, roof-frames, floors, doors and windows. Iron details: sections of cast and rolled beams, joints of iron roof-frames. Small buildings. Minor bridges of timber, masonry and iron. Masonry works of irrigation.

D. Machine Drawing (200).—Riveted joints, bolts, screws and keys. Screw-gearing and valves. Pulleys. Spur and bevil wheels. Pipes and columns. Cast-iron tanks. Details of simple machines. Making sketches from measurements. Drawing pieces of machinery from sketches.

E. Estimating (250).—Simple problems in Mensuration. Taking out quantities from plans of buildings, bridges, irrigation and other masonry works. Plotting sections and estimating earthwork. Calculation of the weight of metal from plans and detailed drawings of simple machines and of structural iron work.

2

PRES

DRAFTSMA

NOTE.—Class instruction will be conveye and Models. None of the Geometrical draw will explain the mode of construction of a student will proceed to make the drawing i kept in view throughout the course is that st men and not mere copyists. Lectures will struction, in illustration of which models will b

Students will be sent out from time to t are not required, but dimensioned sketches w ing these sketches will be put up at the end of which have been executed.

The order in which the different subjects adhered to. Variety should be introduced into be of one kind for a longer period than three morning given to Geometrical Drawing may be to actual drawing, while the afternoon might b construction.

I. **Practical Plane and Solid Geo** ments. Printing. Simple problems plain and diagonal scales. Simple prob polygons. Reduction of a rectilineal Ellipse. Planes of Projection. Repres possible positions with respect to the elevations of straight line, cube, square placed in any position. Plans and elevat in any position. Sections of the above s penetrating solids. Isometric projection

II. **Free-hand, Perspective and M** lines from copies; decorative designs fo perspective of geometrical plane and so objects, such as a table, box, &c. Eleme drawing of simple objects.

III. **Buildings.**—Conventional colou lines and shadows. Projection of shado foundations, walls, segmental, pointed, of carpentry, such as joints, roof-fra Details of roofs and floors, such as t floors. Details of iron-work, such as ro roof joints. General dimensions of roo buildings from models, specification, and quantities, and preparing detail and ab cost.

IV. **Earthwork.**—Delineation of cu ing walls. Gradients. Areas of earthw tion of volumes by prismoidal formula.

V. **Masonry Bridges.**—Bridge foun struction of piers, abutments, and wing dimensions. Arches, segmental, elliptic

REVISED.

filling spandrils. Face and parapet
bridges from models, specification, and

VI. **Timber Bridges.**—Frames of
Trapezoidal truss. Joints. Superstr
models and specifications. Estimates

VII. **Iron Bridge.**—Wrought iron
tion of plate girders; flanges, web,
Usual proportions. Support of ends.
ture. Construction of braced girde
iron bridges from models, specification

VIII. **Irrigation Works.**—Nature
lating works of an irrigation system.
sluices. Canal falls. Locks. Inlets
irrigation sluices. Drawing irrigation
Estimating.

IX. **Machine Drawing.**—Riveted
Shaft couplings and pedestals. Pull
necting rods and cross heads. Details
drilling machine, planing machine, &c

X. **Topographical Drawing.**—Co
Representation of ground by contours
shading.

PLANS AND

to be prepared d

NOTE.—The plans need not be dra

First

Printing, one sheet.
Scales, one sheet.
Practical Plane Geometry, four sh
Practical Solid Geometry, four sh
Masonry details, drawn in ortho
coloured, four sheets.
Timber details, drawn in ortho
coloured, three sheets.
Iron roof on cast-iron columns, sh
Tracing on cloth and colouring a
Free-hand drawing, six sheets.
Perspective drawing, four sheets.
Building, drawn from specificatio
Building, drawn from actual mea
Earthwork embankment and cutt
Masonry bridge, from specificatio
Masonry bridge, from actual mea
Skew bridge, from copy.
Timber bridge, from specification

Second

Model-drawing, six sheets.
Topographical plan.

REVISED.	PRESENT.
	Contoured plan and sections
	Plate girder bridge, from model.
	Plate girder bridge (or a portion thereof
Taking out quantities.	
	Braced girder, from copy.
	Head sluice, drawn from model. Takir
	Canal lock, from specification. Taking
	Tank escape, from specification. Takin
	Tank distribution sluice, from specificati
	Hill-shading, one sheet.
	Rivets and riveted joints.
	Bolts and nuts.
	Screw threads.
	Shaft couplings.
	Pedestal block.
	Brackets and hangers.
	Pulleys.
	Spur wheels.
	Bevil wheels.
	Finished elevation of a large building.
	Finished drawing of a large machine,
ments.	
	Details of machine.

REVISED.

ARTISAN CLASS.

I. ARITHMETIC.

The Compound Rules, Reduction, Vulgar and Decimal Fractions, Practice, Simple and Compound Proportion.

NOTE.—English figures must be used, and the candidates must be acquainted with the principal Indian weights and measures and the English Tables of money, of Troy weight, Avoirdupois weight, of Lineal, Square and Cubic measure, and of Time.

II. MENSURATION.

1. **Definitions** of the various figures concerned.

2. **Lengths.**—Right-angled triangles. Regular polygons. Similar figures. Circumference of a circle. Arc of a circle.

3. **Areas of Plane Surfaces.**—Rectangle. Parallelogram. Triangle. Quadrilateral. Regular and irregular polygons. Similar figures, circle. Sector and segment of a circle. Simpson's rule.

4. **Volumes.**—Rectangular parallelopiped. Prism. Pyramid. Cone and frustum of a cone. Cylinder. Sphere.

5. **Areas of curved surfaces.**—Right circular cylinder. Right circular cone. Frustum of a cone. Sphere. Zone and segment of a sphere.

6. **Miscellaneous.**—Measurement of timber, squared and unsquared.

NOTE.—*Students will be required to calculate areas and volumes from actual measurement of simple objects.*

III. BUILDING MATERIALS AND CONSTRUCTION.

A.—MATERIALS.

1. **Stone.**—Varieties met with in Southern India. Quarrying. Blasting with powder and dynamite.

2. **Bricks and Tiles.**—Brick earth. Tempering. Moulding. Drying. Burning. Firebricks. Roofing, flooring and drain tiles.

3. **Lime, Cement, Mortar, Concrete, Plaster.**—Properties of lime, burning, slaking, mortar mixing, surki, concrete. Practical tests for lime and cement. Plaster. Whitewash.

4. **Timber.**—Seasoning. Characteristics of sound timber. Varieties.

5. **Iron.**—Cast iron. Forms of wrought iron.

B.—CONSTRUCTION.

1. **Foundations.**—Setting out work. Foundations for walls. Masonry and concrete foundations. Wells. Excavators.

2. **Masonry.**—Ashlar. Coursed and uncoursed rubble. Bricklaying in English and Flemish bond. Bond at angles of walls, in footings, between main and cross walls, at door and window openings, and in circular pillars. String courses, cornices, wall plates. Wood bricks and

REVISED.

PRESENT

Same as in colum

plugs. Openings for timber beams. Brick arches, segmental, flat, and relieving. Centres for small arches. Masonry bridges.

3. **Carpentry.**—Mortise and tenon joints. Scarfing. Bolts and straps. Roof frames and their joints. Dimensions of parts. Trussed beams. Doors and windows. Centres.

4. **Roofs and Floors.**—Terrace roofs and floors on joists or beams and joists. Dimensions of timbers. Pitched roofs. Rafters, purlins and reepers. Roof coverings. Simple iron roofs. Floors of stone, brick and concrete. Fire-proof floors.

NOTE.—*Students will be constantly practised in making neat dimensioned hand-sketches.*

IV. PLAN-DRAWING AND ESTIMATING.

1. **Preliminary.**—Simple practical geometry. Scale. Connection between plan, elevation and sections.

2. **Buildings.**—Modes of spreading weight over foundations. Bond at angles of walls, in footings, &c. Details of foundations. Thickness of walls in buildings. Arches. Details of carpentry, such as joints, roof frames, doors and windows. Details of roofs and floors, such as terracing, roof coverings. Iron roof joints. Estimates for simple buildings. Current prices.

3. **Earth-work.**—Areas for earth work sections. Estimation of volumes.

4. **Bridges.**—Piers, abutments and wing walls, with rules for their dimensions. Segmental arches. Rules for rise and thickness of arches. Spandrils. Estimates of quantities.

NOTE.—*Students will be practised in making neat practical drawings to scale from notes or specifications. Drawings may be in pencil, and no coloring is required.*

No 1

Encls to D.P.I. letter No. 5304 dt. 9-5-96

Enclosure no. 1 to Govt. no. 628 Edl

No. 295C.

Dated 25 May 1895.

From.

The Principal, College of Engineering, Madras,

To, The Director of Public Instruction, Madras.

Sir, Referring to your endorsement No. 5836, dated, 17th May 1895, on the Ag: Principal's No. 1270C dated 30 March, I have the honour to offer the following remarks on the report of the Committee appointed to revise the College Syllabuses. This report, with its enclosures, is herewith returned.

2. The most important of the proposals made by the Committee is that found in the twentieth paragraph of their report, regarding the conversion of the present Survey class into a class for Lower Subordinates. I accordingly deal with this matter first.

Encls No 2

3. There can be no doubt that the Committee

Consid

considerable demand exists, both in the Public Works Department and elsewhere, for — named Lower Subordinates (ie) formen who are to carry out in a minor degree the less responsible duties of Upper Subordinates. It may be granted at once that the College ought to meet this demand, which may be taken at not less than 20 Sub. Overseers per annum. In my No. 429C, dated, 16 September 1893, I submitted proposals for developing the present Artisan class which were approved by Government in their order No. 128, Educational, dated, 28 February 94. The Committee, with these papers before them, prefer to employ the Surveyor class as the basis of the proposed class. After careful consideration, I give my adherence to the Committee's proposal.

vide GO 232 Edl 7-4-94.

In regard, however, to the course of instruction suggested, I do not think the Committee go far enough. In their twenty-eighth paragraph they say — "Provided the Surveyor can add to his knowledge of Surveying and Levelling a fairly sound knowledge of the three first Sub-heads (Sic) under Drawing" - i.e (1) Geometrical and Perspective Drawing (2) Freehand and Model Drawing (3) Building Drawing and Estimating — "he will be exactly the stamp of man required for a Sub. overseer in the Public Works Department". With this I cannot entirely agree. The course for a Sub. overseer should include Building Materials and Construction as well as Building Drawing, Estimating and Surveying and Levelling. Perspective, Freehand and Model Drawing, as he Machine Drawing he can dispense with, as he requires only so much Geometrical

Drawing

Drawing as is necessary for the projection of Building Drawing. The necessary Mathematical knowledge can be secured by the Entrance Examination, while manual dexterity should be developed by a short course in the College workshop. The lately Ag: Principal Mr. Davidson, considered that Hydraulics should also be included, vide, his No. 1016C dated, 10 January 1895; but I am of opinion that the subject may be introduced later if found necessary. Details of the revised course will be found later on this note. The new class can be managed without increase of the present number of the staff, provided the proposals lately made in regard to the abolition of the Military Probationer's class are adopted. Assistant who can teach Surveying & Drawing will however be required in place of one of the existing Vernacular

4. The standard of general education for admission to the new class must be superior to that now prescribed for the Surveyor's class viz the Lower Secondary Examination. That standard is too low even for the Surveyor class as at present constituted. For the Lower Subordinate class, I think that the completion of the High School course should be insisted on. The Competitive Examination for admission to the College may be on the same lines as the present examination for the Surveyor class. The fees may be intermediate between those fixed for the Engineer Subordinate and Draftsman classes, viz, Rs 5 per month, or Rs 24 per term. The amount of deposit should be Rs 75. The scholarships should be two of Rs 10 granted on the results of the term examination held at the end of

the

the first year.

5. It should be mentioned however that there is another source from which Lower Subordinates might be drawn viz the present Engineer Subordinate class. There are generally some students in each year who, though successful at the final examination, do not, through lack of means, proceed to the practical Course. These might well be granted Certificates as Sub-Overseers. This proposal is in accord with the views of the Chief Engineer, Public Works Department, as expressed in paragraph 3 of his note published in Proceedings of Government, Educational, No. 232, dated, 7 April 1894. So far as qualifications go, even students who fail in certain branches, such as Mathematics, might be considered eligible to serve as Sub-overseers: but the adoption of any such concession would tend to relax the standard of work done in the Engineer Subordinate class. The Engineer Subordinate class could not in any case, however, fully meet the probable demand for Subovserseers.

6. The point next in importance touched on by the Committee is (paragraph 2 of their Report) the partial assimilation of the Syllabuses of the different classes. I concur in considering that lectures cannot, save in rare cases, be made common to the Engineer and Engineer Subordinate classes, but I think that the examinations in Surveying and Drawing as well as in Building Materials and Construction may be almost identical for all the classes, including the Draftsman Class

and the new Sub. overseer and surveyor class.
class, I have accordingly drawn up Syllabuses
in these subjects common to the several
classes. They will be found in Appendix
A of this report. That in Surveying is
virtually the same as the Committee's.
Those in Building Drawing, Machine
Drawing and Estimating cover much the
same ground as the Committee's Syllabuses,
but are more specific and precise.
No amplification is necessary as regards
the Engineer class to meet the requirements
of the Madras University and it is
desirable for the Junior classes.
The Syllabus in Surveying has the approval
of the Superintendent, Madras Survey,
as suited to his Department.

7. I now take the Committee's paragraphs
Seriatim and note the modifications I
recommend.

recommend.

8. Committee's paragraph 4: Accepted,
save that "annuities" should be omitted
from Algebra, seeing that it does not find
a place in the F.E. Syllabus; While —
"Mensuration" should be included as a
Sub-head because, not forming a part of
the F.A. Examination; there is no guarantee
that persons who have passed the Entrance
Examination have had regular instruction
in the subject.

9. Committee's paragraph 5. A. Physics.
The items "Friction" and "Principle of work
and its application to Simple machines"
should stand under the sub head
Statics, as they are required in the F E
Syllabus in Science. It is true that they
appear again in the College Syllabus
on Principles of Mechanism, but they
would in the latter be dealt with
experimentally

experimentally rather than mathematically.

With regard to the Committee's remarks on B. Chemistry I would point out that the College Reorganisation Scheme originally contemplated the division of the instruction in Experimental Science between the Professors of Engineering and Mathematics, Vide my No 485-C. dated 27th August 1885. As the present Professor of Engineering is the only member of the staff capable of teaching Chemistry, the existing arrangement must continue until further teaching power becomes available. The Committee have been misinformed in stating that Mr Whiteley gave no instruction in Chemistry. As regards b. Geology, I agree with the Committee in considering that the subject should be cut out.

in G.O. 328 27-5-1886

10. Committee's paragraph b. The Committee advise the omission of C Bridge Construction and D Earthwork Roads and Railway Construction

I agree generally with their observations, but consider that to meet the requirements of the B.E. degree Examination as well as those of the College, the following additions should be made to the syllabus in B Building Construction, as revised by the Committee. Under (3). Carpentry, (1) for "roof-frames" read "roof and bridge frames"

Add "(5) Bridges - names of parts, thickness of arch ring, wing walls, centerings, setting up arches full size. [Simple iron bridges.]

Add "(6) Roads &c — Road construction and maintenance [General principles of Railway construction]

Note. The portions in brackets [ ] are not required for the College examinations.

Under E Hydraulics which should be relettered "C" the following addition should be made to meet the requirement of the B.E. Syllabus. [(2) Water Supply of Towns and Town Drainage. Brief general description.] It may be remarked

remarked that if lectures in this subject are entirely
dropped candidates for the L.S.Sc degree
may have difficulty in producing the certificate
required by by-law 248 of the Madras
University Calendar. The alterations proposed
in Fr. Applied mechanics which should
be relettered "D" are accepted. Gj. Principles
of mechanism and H Steam Engine should
be combined to form one Syllabus to be
lettered E. The following additions should
be made to this syllabus to meet
University requirements. Under Mechanical
arrangements of Machines add
"[Hydraulic Machines]" For the Sub-head
Stationary Steam Engines substitute
Steam Engine, and add under it
"[general description of the locomotive
and its principal details]"

11. Committee's paragraphs 7 and 8 have
been dealt with in my fifth paragraph Supra.

12. Committee's paragraph 9. I consider that the
marks proposed by the Committee for Algebra,
Chemistry, Hydraulic Engineering and Geometrical
& Drawing are too high, while those allotted
to Heat and Building Materials and
Construction are insufficient. Marks for
Mensuration should be provided.
Geometrical and Perspective Drawing should
be separated from Freehand and Model
Drawing, as distinct papers will have to be
set. Under Surveying, it is considered that
too much credit is given for the Board's
paper work as compared with the more
important field and office work marked
by the College. Since the examination in
Physical Fitness is to be conducted
by the College in future, the allotment
of total marks will be (vide College Rule
Article V(1)(a)) Board 2300, College 700. To
meet these requirements, a revised
distribution

distribution of marks is given in Appendix B.

Committees paragraph 11. The proposals regarding the mathematics of the Engineer Subordinate class are accepted, some in regards to F Statics. Some knowledge of Statics is absolutely essential to the study of applied mechanics. Poor results have hitherto been obtained in Statics because both teaching and examination have been of an academic order, notwithstanding the note appended to the existing syllabus. I am of opinion that Statics must continue to be taught, but I think that the brief syllabus required may advantageously be included in that for Applied Mechanics.

13. Committee's paragraph 12. The proposals are accepted as regards A. B. C. D. E and G, (the syllabuses in A & B being the same as those advocated for the Engineer Class in Appendix A.). Subjects E Hydraulics and G Mechanism and the Steam Engine will

will be relettered "C" and "E" respectively. In Applied Mechanics, which will be relettered "D", the first clause should be amplified as follows:-

(1) Preliminary Parallelogram, triangle, and polygon of forces; parallel forces; moments; Centre of gravity; specific gravity; energy, unit of work, horse-power. Dead and live loads; stress and strain; Hooke's law; modulus of Elasticity; factor of safety; resistance of building materials to stress.

14. Committees paragraphs 13, 14 and 15. The Syllabuses in Drawing and Surveying should be as laid down in Appendix A. The existing instructions regarding the number of drawings and surveys to be executed during the course were very necessary at the time of their issue, and resulted in the quadrupling of the work formerly done. The time has now arrived however when they may be suspended.

15.

. Committee's paragraphs 16. The apportionment of
arks to the Engineer Subordinate class is
usceptible of improvement. My proposals will
found in Appendix B. The sanctioned allotment
etween Board & College is, allowing for
the transfer of Physical Fitness to the latter,
Board 1525, College 475.

16. Committee's paragraphs 17, 18, 19 and 20.
The views expressed in the first three of
these paragraphs are concurred in. The last
paragraph has been dealt with in my
paragraph 3 Supra.

17. Committees paragraphs 21, 22, 23 and 24. Agreed to.
The abolition of the two classes of certificate
at present authorized for the Engineer and
Engineer Subordinates, should for the sake
of uniformity, follow the corresponding
abolition in the case of the Draftsman
and Surveyors. At the same time, to mark
special proficiency, students who secure 66 per
ent of the total marks should be
mentioned

mentioned as passing "with honours" if they belong
to the Engineer or Engineer Subordinate class,
and "with credit" if they belong to the
Sub-overseer and Surveyor or the Draftsman
class.

18. Committee's paragraphs 27, 28 and 29. The
development of the Surveyor class renders a
new designation for the class desirable.
At Roorkee the corresponding class is known
as the "Lower Subordinate class". This
implies the existence of an Upper Subordinate
however, a title for the Engineer Subordinate class
class which is not recognised in Madras.
I think the class should be known as
the "Sub-Overseer and Surveyor class", as
this designation will clearly indicate the
kind of appointments for which the men
will be trained. The mark distribution
proposed will be found in Appendix B,
and the Syllabuses in Appendices A and C.

19. Committee's paragraphs 25 and 26. I consider
that the Draftsman class should study
and

and be examined in Building Construction, and that it would be advantageous for the Students to have some practice in Carpentry. The Syllabus in Building Construction will be found in Appendix A. The Committee observe that the Boards should have more power in their hands in regard to the marking of this class; yet, in their mark table, they assign 500 marks to the College instead of 400 as at present. It is not clear moreover why the marks for Building Drawing should be given wholly by the College. I submit a revised mark table in Appendix B and the Syllabuses in Appendices A and B.

20. Committee's paragraph 31. With the views expressed in this paragraph I am entirely in accord.

21. A complete set of the syllabuses recommended for adoption will be found in Appendix C. Syllabuses in Language and Physical Fitness have been for the first time included. That in Language is applicable

applicable to the Engineer and Ex-Engineer, Subordinate classes, and that in Physical Fitness to all the classes except the Artisan class.

22. The proposed division of subjects and marks between the term and final examinations is set forth in Appendix D. This division will be subject to slight modification from time to time. It should be borne in mind that more ground will usually be covered by a years' work than by the examination at the end of that year. The examination in fact covers only such subjects as can be disposed of finally during the year.

23. Although not contemplated by the Committee, I think some change is called for in the qualifying minima prescribed for the various certificate examinations. The Boards of Examiners have more than once complained that the present system sometimes permits a student to pass, especially in the Draftsman and Surveyor

Surveyor classes; notwithstanding indifferent examination results. This would be remedied by fixing a minimum percentage to be obtained on the total of the Board's marks as well as on the grand total. If classes of certificates are abolished, these percentages should be 50 in all cases.

24. The present system of requiring a separate minimum on each of the main subject heads has not been found to work well, inasmuch as it does not permit of the weeding out, during the course, of students whose progress is unsatisfactory. A main subject-head is rarely disposed of till the final examination; so that uncertainty exists until then whether a student may not ultimately succeed in qualifying. The objection will be avoided by abolishing the subject-head percentages, and requiring a minimum on the total marks awardable at each Term examination. That minimum may be 50 per cent. A student who fails at a Term examination should be permitted to continue for another Term in the same division of the Class. A second failure at any period of the course should involve dismissal.

25. The standard of general education for admission to the Draftsman class viz the Lower Secondary Examination, should be raised. I consider that candidates for admission should have spent not less than one year in a recognized High School. The Entrance Examination for the college may continue on the same lines as at present. The amount of deposit made on joining the College should be raised to Rs 60.

26. It is suggested that special facilities in regard to admission might be offered to students of Technical Institutes who desire to join either the Sub-overseer and Surveyor or the Draftsman class.

If

If district Institutes are affiliated to the College of Engineering as proposed by me in my Annual Report for 1893, such facilities must undoubtedly be given.

27. A copy of the College Rules as proposed for revision will be found in Appendix E. The alterations and additions made are those only which are brought forward for the first time in this note. Other revisions have been advocated in previous communications, such as my Nos. 1636 C dated, 31 March 1894 and 115 C dated, 27 April 1895.

28. I would add in conclusion that, provided the changes recommended in this note can be publicly notified not later than September next, the new Sub-overseer and Surveyor class may be formed in January 1896, the entrance examination taking place in the November preceding. Qualified Sub-overseers would then become available for employment in January 1898. As I learn that there is pressing need of their services in the Public Works Department, I hope it may be found possible to issue the notification in time. The revised syllabuses and mark distributions may be introduced - if not in their entirety, then as far as possible - from 1 January 1896 for all students belonging to the College on that date. The term and final examination of December 1896 would thus be the first to be held under the revised rules.

I have &c.

Sd/ H. D. Love, Major R.E.

Principal

(True copy)

D Duncan

Director of Public Instruction

No. 3
Encl to D.O. letter
No. 6304
9-5-96

III

Enclosure no. III to Current
no. 628 E.D.L

OFFICE OF THE DIRECTOR OF
PUBLIC INSTRUCTION,
Madras, 19 August 1895.

No. 8996.

From

THE HONOURABLE MR. D. DUNCAN, M.A., D.Sc.,
DIRECTOR OF PUBLIC INSTRUCTION,
Madras,

To

The Chief Engineer.
D.P.W.

SIR, Experience having shewn that the present Syllabuses of the College of Engineering needed revision in several important directions, a committee consisting of the gentlemen named in the margin was appointed in January last to revise the college ~~of~~ syllabuses. The revised syllabuses were received in this office with the Committee's report early in April, and were referred to Major Lowe. His suggestions on the Committee's proposals are embodied in the accompanying report, and I have the honour to request that you will be good enough to

Mr. F. R. Davidson
Mr. H. C. West
" R. I. Ellis
" A. Chatterton
Lieut. R. Hamilton & Ramsay

40

Ed. Cor. 22 1,000-23-11 95.

As favour me with your views thereon, before I address Government on the various recommendations.

2. I beg to be favoured with your particular opinion on the following points.

(i) The proposed reconstitution of the Surveyor class and its designation as Sub-overseer and Surveyor class.

(ii) The raising of the standard of admission into sub-overseer and Surveyor class. We were feel that a candidate has completed the High School course is generally not always a sufficient guarantee that he possesses that amount of knowledge which a Matriculate is expected to possess; but if admission to the class is restricted to Matriculates, a sufficient supply of students might not be available, for the present at any rate.

(iii) The grant of certificates as Sub-overseers to the Engineer subordinates, who, after passing the college final examinations, do not proceed immediately to the practical course.

(iv) Making the examination in Surveying + Drawing and in Building materials and construction identical for all the classes except the artisan class

(v) The alterations proposed by Major Lowe in the syllabuses of Study and in the apportionment of marks.

(vi) Major Lowe's proposals to do away with percentages of marks in individual subjects and to require a minimum of 50 per cent in the total marks awardable at each Term examination and 50 per cent in the college marks.

(vii) The expediency of making the results of the college final examinations depend solely on the marks awarded by the Board of Examiners, the college marks being used to determine the eligibility of students for admission to the examinations held by the Board.

I have &c.
Sd. D Duncan
Director of Public Instn.

(True copy)

D Duncan
Director of Public Instruction

No. 4

Enclo to 6881 letter
No 6304
5-5-96

IV

Enclosure no. IV to Circular
no. 6281 Dl

No. 902 D

Government of Madras.

Public Works Department

To The Director of Public Instruction,
Madras,

Octacamund 2 September 1895.

Sir, I have the honour to acknowledge the receipt of your letter No. 8996, dated, 19 August 1895 on the subject of the revision of the syllabuses of the College of Engineering and in reply to offer the following remarks:-

I concur in proposals I to (III) under para 2 of your letter, and also in Major Lowe's suggestions (IV) so far as they are in accordance with my reply to proposal (VII).

I am somewhat doubtful about proposal VI, but I am not prepared to object to it if it is considered desirable from an educational point of view

I have &c.

Lt. J. Pennycuick Colonel
Chief Engineer P.W.D.

(True copy)

D Duncan
Director of Public Instruction

To

No. 5

Encls to D.P.I. letter
No. 5304
9-5-96

No. 732. Executive Engineer's office,
Coimbatore, 9 March 1896.

From,

F. W. Ashpitel Esqr.,

President, Board of Examiners,
College of Engineering, Madras.

To The Director of Public Instruction,
Madras.

Sir,

I have the honour to inform you that I delayed replying to your letter R. No. 1171, dated, 10 February 1896, until I had an opportunity of seeing Major Lowe as it appears to me that the revised syllabus for the sub-overseer and Surveyor and for the Draftsman class is too extensive. I understand that this is due to the instruction issued to the Committee to make the syllabus for each subject as nearly as possible the same for all classes.

2.

Enclosure No. 4 to Circular
No. 628 Edl

2. As I find that Major Lowe agrees with me that the syllabus for the Sub-Overseers, in especial, contains much that is not required for the due performance of their duties on works and that the necessity ~~for~~ of studying these extra subjects may take so much time as to imperil the efficiency of the class, I would suggest that the instructions regarding uniformity in the syllabus should be cancelled and that the Principal be asked to reduce the syllabus for the classes mentioned in para 1 of this letter by cutting out those portions which he considers unnecessary or which may be dispensed with without serious loss of efficiency. I only make this suggestion as I am afraid that by attempting too much nothing will be done thoroughly well, as it is notorious that the standard of education of the men forming the Sub-Overseers and Draftsman classes is not high, and to try to cover such an extensive syllabus is not likely to lead to efficiency.

3. I have no remarks to make on the syllabus for the Mer. classes except that, in my opinion, the revision is likely to lead to a great improvement in the College course of instruction and appears to me to meet all requirements.

I have &c.

Sd/ F. W. Aspital

President,

Boards of Examiners

(True Copy)

J. Duncan

Director of Public Instruction.

CURRENT NO. 296

Executive Engrs office
Calicut 5th Feby: 1895.

No 62 S.E.

From.

H. H. O'Connell Esq.
Executive Engineer
West Coast Dn.

To

The Supdg: Engineer
4th Circle, Coimbatore.

Sir,

With reference to the testing of Lightning Conductors, I have the honor to point out that none of the officers or upper Subordinates in this Division have learnt how to carry this out. I believe Government some years ago ordered that officers and upper Subordinates should learn this very necessary accomplishment.

2. I am sure officers and upper Subordinates will not take

No 6
Encl: to PWD's letter
No. 5304
9-5-96.

Enclosure no. VI to Current
No. 628 E&L

take the trouble to learn unless Government rewards those who do or refuses to promote those who wont, just as is done with re-gard to languages.

3. I beg to point out that a good deal of extra work is thrown on the few who have learnt, as the majority escape the work involved by pleading ignorance.

4. I would, therefore, suggest that Government be asked to put the acquiring of this accomplishment side by side with the acquiring of languages.

I have &c.
Sigd H. O'Donnell
Executive Engineer

No 64/W of 9th February 1895.

Copy. Forwarded to the Chief Engineer, P.W. Department, for consideration.

It is thought that the testing of lightning Conductors might be included in the Civil Engineering College curriculum

Unless lightning Conductors are regularly tested and when found defective put to rights they are a source of danger rather than safety. It is probable that most of the Conductors attached to public buildings would come under the former Catagory.

H. O'Donnell
Asst Dy. Engineer 4th Circle

Ext. P. W. CURRENT No. 1081

Civil Engr. CM. Madras

From

The Supg. Engineer,
4th Circle.

CURRENT NO. 296

Dated 9th February 1895.
Despd. 12th "
Rad Recd 11/3

No. 614/45.

Rec'd: 13-2-95
No. 927 C d/8 - March 1895

Testing of Lightning Conductors.
Suggesting that the learning of — might be included in the Civil Engineering College Curriculum for reasons explained.

Orig. 12
637/95

Referred to the Educational Dept. the Chief Engineer concurs in the Supty: Engineer's recommendation.

18 MAR 95
MADRAS

Col. RC
Secretary to Board.
A.W.B.

Copy 14/3/95

TO BE RETURNED WITH REPLY.

Referred

[G/69]
250—23-1-95.

CHIEF SECRETARY MADRAS.

OFFICE OF THE DIRECTOR OF PUBLIC INSTRUCTION,
Madras, 9 May 1896.

Current No. 628

Memoran... UNCAN, M.A., D.SC., LL.D.,
DIRECTOR OF PUBLIC INSTRUCTION,
Madras,

...F SECRETARY TO GOVERNMENT,
FORT ST. GEORGE.

From

...ment, dy ...

Re...
Instruction ...

Fort St. George,
11th March 1895.

I have the honour to submit, for the ... approval of Government, ... ses of the College of ... the present and the revised ... given side by side in ... ns for convenience of reference ... s for the changes have been ... in the last or remarks ...

To

The Director ...

... A syllabuses, drawn up many ... e been found redundant ... s and much too detailed ... us in others, and the Board ... of

GM

of Examiners of the College have brought
to notice more than once that radical
changes were necessary under several heads.
A committee consisting of the gentlemen
named in the × margin was accordingly
appointed in January 1895 to revise the
syllabuses. The revised syllabuses were
received in this office in April 1895 with
a covering report which is herewith submitted
for perusal. They were referred to
Major Love on his return from Europe,
and towards the end of July last,
he sent them back with a few, but
very important modifications, which
are explained in full in his letter
No. 295 C, dated, 25 July 1895, copy of
which is herein enclosed. Col. Pennycuick,
to whom the papers were then forwarded
for opinion, approved of the revised
syllabuses

× Mr. J.R. Davidson, Ag: Principal.
" H.C. West.
" R.E. Ellis.
" Alfred Chatterton
M.R.Ry B. Hanumantha Rau.

vide Encls. No. 2

vide Encls No. 3

syllabuses with the alterations suggested
by Major Love. They were next thrown
into their present form and a proof copy
was referred to Mr. Ashpitel, President
of the Board of Examiners of the College.
He pointed out (vide copy of his letter
enclosed) that the revised syllabuses
for the Sub. Overseer and Surveyor classes
and the Draughtsman class had, for
the sake of uniformity, been made rather too
extensive. These have accordingly been again
amended by the Principal. It will thus
be seen that the syllabuses have been
subjected to a thorough criticism and are
calculated to improve considerably the
efficiency of instruction imparted in the
College.

Vide Encls. 6.

3. The salient points in the revised syllabuses
will be briefly referred to below:—

(1) Engineer class. The subjects and portions
of subjects tested at the First Examination
in

in Arts, or the College Entrance test have been expunged from the College course, the redundant portions and repetitions have been omitted, the requirements of the B.E. degree Examination have been supplied; portions of such subjects as Earth-work, Bridge-work, &c., which the student will learn better by spending a short time in practical work than by attending a number of lectures in class rooms, have been omitted. In short, a general reduction in quantity has been aimed at with a view to secure better quality and greater accuracy.

(ii) Engineer Subordinate class.-

The subjects and portions tested at the Matriculation or the Upper Secondary Examination or the Entrance Examination have been omitted from the College course, the redundant portions and repetitions have been omitted, portions of such subjects as Earthwork, Bridgework &c., which are better learnt by the student while on works than while in the College, have been struck out; and as in the case of the syllabuses for the Engineer class, better quality has been aimed at throughout rather than a superficial knowledge of a larger number of subjects.

(iii) Sub-overseer and Surveyor Classes.

In his letter No. 70, dated, 8 April 1894, Mr. Monro submitted to Government, with his recommendations, certain proposals of Major Lowe for developing the Artisan class into a ~~subordinate~~ Sub-overseer and Maistry class. — Government referred the proposals to the D.P.W. (G.O. No. 128, Educational, dated, 28 February 1894), observing that they seemed generally judicious. After a full discussion, the Committee appointed to revise the syllabuses proposed to employ the Surveyor class as the basis of the Sub-Overseer class, and both Major

fp 128 / 28-2-94

Major Love and Colonel Pennycuick are in favour of the Committee's proposal. This is decidedly a better arrangement than what was originally suggested by Major Love and recommended by Mr. Mouat, for the reason that the candidates entering the Surveyor class are, as a class, much superior to those entering the artisan class, undergo an extended course of instruction, and are consequently better fitted than trained artisans and maistries for employment as Sub-Overseers in the Public Works Department. The syllabus as finally revised by Major Love and incorporated in the revised syllabuses herewith submitted seems suitable. The designation proposed for the class is also quite appropriate and may be adopted.

(IV)

(IV) Draughtsman class:- The revised syllabus drawn up by Major Love with reference to the Committee's recommendations and Mr. Ashpitel's remarks has been adopted

(V) Artisan class:- No change has been made in the syllabus for this class.

4. At the final examinations conducted by the College Board of Examiners the Session marks assigned by the College staff have hitherto been added so as to determine the eligibility of candidates for certificates. Opportunity was taken of the revision of the syllabuses to consider, first, whether the Session marks should continue to be added to the marks awarded by the Board of Examiners at the final Examination and, Secondly, if so, whether a separate qualifying minimum for a pass should be

lee fixed in the marks allotted by the College staff and the Board of Examiners. In its order No 100, Ed., of 21 February 1896, Government decided that session marks should continue to lee added to the final examination marks except in the case of the Draughtsman class; and though I was, and I am still, of opinion that this arrangement is inexpedient, I do not propose to reopen the question at present. It is agreed on all hands that, if session marks continue to lee added to the final examination marks, a separate minimum should lee insisted on for a pass, and the Principal's suggestion that a minimum of 50 per cent lee fixed in each case has met with general approval. The special Committee appointed to revise the Syllabuses

syllabuses also submitted a revised Table of marks to suit the altered scope and condition of the several syllabuses, and Major Lowe has proposed a redistribution with reference to the modifications suggested by him in the several syllabuses. The marks recommended by the Principal for the main subject-heads under each of the several classes are compared below with those suggested by the Committee and those now assigned. Government having decided to exclude session marks in the case of the draughtsman class, the marks originally proposed, viz: 1000, have lieen redistributed over the several subjects. With the above modification, the scheme of marks recommended by the Principal has my approval and is recommended for sanction. In the revised draft syllabuses, details are entered of the marks awardable by

by the Board of Examiners.

Classes and Subjects	Marks now assigned	Marks proposed by the Committee	Marks proposed or approved by Major Love		Remarks.
			Board	Session	
Engineer class.					
Mathematics	475	400	450	"	(a) 600 marks are awarded by the College staff
Science	525	500	425	75	and 2400 marks by the Board of Examiners.
Engineering	775	700	500	200	(b) The Committee would have 725 marks for the
Drawing	500	600	450	150	College staff and 2275 for the Board of Examiners
Surveying	400	550	325	175	(c) The Principal would have 700 marks for the
Vernacular Language	200	150	150	"	College staff and 2300 for the Board of Examiners.
Physical fitness	125	100	"	100	
	3000 (a)	3000 (b)	3000	(c)	
Engineer Subordinate class					
Mathematics	370	400	350	"	(d) 400 marks are awarded by the college staff
Engineering	1600	600	450	150	and 1600 by the Board of Examiners.
Drawing	400	400	325	125	(e) The Committee would have 500 marks for the
Surveying	350	400	275	125	College staff and 1500 for the Board of Examiners.
Vernacular Language	180	100	125	"	(f) The Principal would have 475 marks for the
Physical fitness	100	100	"	75	College staff and 1525 for the Board of Examiners
	2000 (d)	2000 (e)	2000	(f)	
Sub-overseer and Surveyor class					
Surveying	670	700	400	300	(g) 400 marks are awarded by the college staff and 600 by the Board of Examiners
Engineering	"	"	225	50	(h) The Committee would have 400 marks for the
Drawing	280	250	375	100	college staff and 600 for the Board of Examiners
Physical fitness	50	50	"	50	(i) The Principal would have 500 marks for the College
	1000 (g)	1000 (h)	1500	(i)	staff and 1000 for the Board of Examiners.
Draughtsman class					
Geometry & Perspective Drawing	100	100	75	"	(j) 400 marks are awarded by the College
Freehand & Model Drawing	120	100	75	"	staff and 600 by the Board of Examiners.
Building Construction Drawing	270	200	400	"	(k) The Committee would have 500 marks
Topographical Drawing	80			"	for the College staff and 500 for the Board of Examiners
Machine Drawing	200	200	200	"	(l) The Principal proposed to give 400 marks
Estimating	180	350	250	"	as session marks 50 for Physical fitness,
Physical fitness	50	50	"	"	50 for workshop practice and 300 for
	1000 (j)	1000 (k)	1000 (l)		Drawing office work. But as Government has directed the omission of Session marks from the final total in the Draughtsman class, the marks have been redistributed

5. In the Engineer and Engineer-Subordinate classes the proportion of session marks to the total No. of marks is now $\frac{6}{30}$ths & $\frac{16}{80}$ths, and Major Love's redistribution would raise it to $\frac{7}{30}$ths & $\frac{19}{80}$ths respectively. As the proportion he would fix is below that suggested by the Committee, I would adopt his recommendation so long as Session marks continue to be added to the final examination marks. The proportion of session to total No. of marks in the case of the Sub-Overseer and Surveyor class is $\frac{1}{3}$ in place of $\frac{2}{5}$ths, the present proportion.

Because the examination in Physical fitness has been transferred to the College staff vide para 12 of Major Love's letter. Encls. III

6. The College rules now require that, for a pass at the final examination held by the Board, Engineers and Engineer-Subordinates should secure a certain minimum in each subject and 50 per cent of the final total marks; and Surveyors and draughtsmen a certain minimum in almost all the subjects and 50 per cent

vide art V of the college rules

of

of the final total marks. Major Love observes, para 24

"The present system of requiring a separate minimum on each of the main subject-heads has not been found to work well, in as much as it does not permit of the weeding out, during the course, of students whose progress is unsatisfactory. A main subject-head is rarely disposed of till the final examination; so that uncertainty exists until then whether a student may not ultimately succeed in qualifying. The objection will be avoided by abolishing the subject-head percentages, and requiring a minimum on the total marks awardable at each term examination. That minimum may be 50 per cent. A student who fails at a term examination should be permitted to continue for another term in the same division of the class. A second failure at any period of the course should involve dismissal." The obvious effect of this radical change would be that Candidates

Encls. 3.

vide Encls. 5

2

Candidates failing to secure a minimum in an important subject might pass if they obtain a few more marks in a comparatively unimportant subject. Colonel Pennycuick writes that he is somewhat doubtful about this proposal, but that he is not prepared to object to it if it is considered desirable from an educational point of view. In all the public examinations I know of, qualifying minima are required in all important subjects and this must be insisted on in the case of the College of Engineering. I would, accordingly, recommend that the following minima be required at the final examination of the several classes:-

Engineers. One third of the total marks in each of the following subjects, namely, Mathematics, Engineering and Drawing, and 50 per cent on the final total.

Engineer Subordinates.

One third of the total marks in each of the

the following subjects; namely, Mathematics. Engineering, Drawing and Surveying and 50 per cent on the final totals.

Subovseers and Surveyors.

One third of the total marks in each of the following subjects, namely, Surveying, Engineering and Drawing, and 50 per cent on the final total.

Draughtsmen One third of the total marks in each subject and 50 per cent on the final total.

No minimum in Surveying need be demanded in the case of Engineers. The present subject minimum in the case of surveyors and draughtsmen is 36 per cent. I would fix it at one third as in the case of Engineers and Engineer Subordinates.

7. Successful Engineers and Engineer Subordinates are now divided into two Classes

classes, the first class containing candidates who obtain Three fourths of the total marks; Successful Surveyors and draughtsmen into three classes the first class containing candidates who obtain 66 per cent in certain subjects and 75 per cent on the total, the second class 50 per cent in these subjects and 66 per cent on the total and the third class 36 per cent in these subjects and 50 per cent on the total. The college has never been able to turn out first and second class Surveyors and draughtsmen in sufficient numbers in consequence of the high minimum to be secured in individual subjects; and the D. P. W. is reported to have experienced much difficulty in finding first and second class certificates men for service. After a person has entered service with the necessary qualifications, his application to his work and his success in it are the points which must

must chiefly regulate his promotion and not merely the class of certificate he holds. After going through the correspondence on the subject I have come to the conclusion that a uniform classification must be adopted in regards to all certificates awarded by the College, the first class certificates being awarded, as at present, to the successful Engineers, Engineer Subordinates and Sub-overseers and Surveyors who obtain 75 per cent of the aggregate marks and successful Draughtsmen obtaining two-thirds of the aggregate marks. Second class certificates should be awarded to all other successful candidates. Major Lowe suggests that, with a view to mark special proficiency, students who secure 66 per cent of the total marks should be mentioned as passing "with honour" if they belong

para 17 Encls III

to the Engineer or Engineer Subordinate class, and "with credit" if they belong to the Surveyor or the Draughtsman class. But the difference between 50 per cent, the minimum for a pass, and 66 per cent recommended for the first class is not sufficiently marked; and at any rate, I would not reduce the minimum for a first class to below 75 per cent, the present limit in the case of Engineers and Engineer subordinates, and Suboverseers and Surveyors, as session marks are to be included in the final total.

8. As regards the proposal of the Superintending Engineer, Fourth Circle, to introduce into the College Syllabuses the subject of the History of Lightning Conductors (Papers herewith returned) I beg to state that the Committee appointed for the revision of the Syllabuses is not in favour of the suggestion as the matter is of no practical

Encls 7

orgeneral value, and as it is required only for the purposes of the D.C.W. The Committee thinks that the subject may be taught during their practical course, only to those students who, by passing the final examination, are eligible for appointments in the D.C.W, and Major Lowe is of the same opinion. I think the above suggestion may be acted upon. One of the senior members on the staff of the college may be required to give the necessary instruction in this subject to the batch of students during their practical year, when the students have to undergo the equitation course also.

9. The Principal assures me that no additional cost will involve to Government on the introduction of the revised Syllabuses, especially with reference to the development of the Surveyor class into an Sub-overseer and

and Surveyor class.

10. Major Lowe is inclined to think that the standard of admission into the Sub-Overseer and Surveyor class should be raised; but the way in which he would have this done, viz, by admitting As the Entrance Examination. Candidates who have gone through the high school course does not commend itself to me. The mere fact of a candidate having gone through the upper secondary course of study is no guarantee that he possesses much higher attainments than those who have passed the Lower Secondary Examination and not gone through a higher Course. The standard of the entrance examination which the students have to pass whether they have gone through the upper secondary course or not, may gradually be raised so that efficient men may be selected for admission into

into the classes concerned.

11. Mr. Ashpitel's note referred to in the Committee's report, copy of my letter to the Chief Engineer and his reply regarding the syllabuses and connected questions are enclosed for information. Encls. 9 Encls. 4 Encls. 5

12. In para 5 of his letter No. 295C, dated 25 July 1895, the Principal suggests the grant of certificates as Sub. Overseers to Engineer Subordinates who after passing the theoretical examination do not, through lack of means, proceed to the practical course. I see no objection to this suggestion. Encls. 3

13. The question relating to fee-rates and scholarships in the new Sub. Overseer and Surveyor class will be considered in connection with the revision of the College rules.

14. In conclusion, I beg to state that if orders are passed on this letter before September next, the revised syllabuses may be brought into force from January 1897.

I have the honour to be,
Sir,
Your Most Obedient servant,

D Duncan

Director of Public Instruction.

Educational

Current No 628

Edl-Go 100 : 21-2-96 Mis
-u- 807 : 7-10-95 -u-
-u- 613 : 18-8-94 -u-
-u- 232 : 7-4-94 -u-
-u- 728 : 28-2-94 -u-

From,

The Director of Public Instruction,
Madras.

To,

The Honourable the Chief Secretary
to Government,

DESPATCHED
14 MAY.96

No 5304

Dy C. } 12 May 1896.
Secy to G. }

Regd. 14/5/96.

Regd 15/5

Enclos 9.

Further papers in 128/94 sh

807/95

Subject

College of Engineering, Madras

Submitting for consideration and approval revised Syllabuses of the ——

[25 A.]
1,000—21-3-96.

Ed Department.

C. No. 628 of 96

FOR ORDERS.

The revised Syllabuses have been prepared by a strong committee, mainly by Major Lowe with reference to his own observations & those of Mr Aspinall & approved by Col Prangnell & D^r Duncan all the alterations W^h have been made seem wholly desirable so I think they should by all means be accepted.

JG

The present Syllabuses in force at the College of Engineering were approved by Govt in 1889. vide GO. no. 750 Ed. dt 3rd Dec. 1889. The Syllabuses now submitted by the D.P.I. appear to have been very carefully revised. Submitted that they may be approved and published in the Gazette. Should experience show that a change is necessary under any head, such change can conveniently be made later on. No extra cost is involved in this introduction.

The D.P.I's letter deals with several other matters which are noted ~~###~~ below:—

(1) In para 4 of his letter the D.P.I. deals with the marks to be allotted to the different subjects embraced in the

Syl-

Syllabuses. The Scheme recommended by Major Lowe as modified by the D.P.I. (in the case of the Draughtsman class) may be approved!

(2) The proportion of Session marks to the total number of marks recommended in para 5 of the letter does not differ greatly from the existing proportion; it may therefore be approved! The enhanced proportion is rendered necessary by the transfer of the examn. in physical fitness to the College staff.

(3) The changes advocated in paras 6 & 7 of the letter are more important and require careful consideration. At present there are two classes of certificates for the Engineer & Engineer Subordinate Students and three classes of certificates for the Draughtsman & Surveyor Students; E & E.S. students have to obtain a certain minimum in each subject and 50% of the total marks for a pass in the second class and 75% for a pass in the first-class; the D & S. students have to obtain a different minimum in almost all the subjects and a different minimum in the total marks for a pass in the 1st, 2nd & 3rd classes. It is now proposed to reduce the classes of certificates to two in all cases, to reduce the no. of subjects in which a separate minimum is required and to prescribe a uniform minimum for a pass. For a first class certificate 75% of the total marks will be required as hitherto. The Director seems to hold that a reduction in the number of subjects in which a separate minimum is required is necessary. The changes may perhaps be approved: The minima are only 30% which is very low.

The changes in the case of draughtsman certificates will if approved, slightly affect the wording of the rules regulating the appointment and promotion of draughtsmen in the P. W. D. approved in G.O. no. 986 Ed. dt 22nd Dec. 1894 but this can easily be remedied.—

(4) Para 8 of the D.P.I.'s letter replies to the Reference on

FOR ORDERS.

H. E. THE GOVERNOR.
THE HON'BLE MR. H. W. BLISS, C.I.E.
THE HON'BLE MR. J. GROSE, C.I.E.

The minima as proposed by the DPI in the case of subjects must be required

The Director's proposals should be accepted. 30% is not too low for the separate subjects.

Cuo 296 of 95- D 16th march. no. 569 regarding the introduction of the testing of lightning conductors as a Subject of Study at the college of Eng.- The Committee which revised the college Syllabuses is not in favour of introducing it- but it is suggested that the Subject may be taught to such Students as are eligible for appointment to the P.W.D- during their practical course. The reason assigned for restricting the instruction to such Students as are to enter the P.W.D. is not convincing- The subject may be taught to all Students who undergo the ~~equitation~~ course!

history of the

Submitted that this may be approved.

The D.P.I. & Major Lore are in favour of the suggestion.- So am I.
Jy

(5)- In his letter D 8th January 1894 no. 70, the D.P.I. Submitted proposals for the institution of a final test for the mistry & artisan class. In G.O. no. 12 of 3rd D 28th Feb. 94 the Govt approved the proposals generally & referred them to the Chief Engineer for remarks- The Chief Engineer pronounced the class to be worthless for the purposes of the P.W.D. & his opinion was

with a view to making the successful candidates eligible for appointment as Sub-overseers.

Vide para 3 (iii) of the D.P.I's letter

Yes. The changes seem to have been well considered & will be good in every way.
Jy

referred to the D.P.I. for remarks in G.O. no. 232 Ed. D 7th April 1894- The Committee which revised the Syllabuses has considered the matter and has proposed to reorganize the Surveyor class so as to supply the demand of the P.W.D. for Sub-overseers.) The proposals is reported to have received the approval of the Chief Engineer (Col. Pennyquick). It is also reported that no addl cost will be involved by the proposal. Submitted it may be approved.

(6). To grant a certificate of having completed only the theoretical course to the Eng. Sub-Students referred to in para 12 of the letter & to declare such certificate holders to be eligible for employment as Sub-overseers seems preferable to the D.P.I's proposal to grant them Sub-overseer's certificate but the point is a very small one.

W 7.7.96

Ind
15/7/96

Revised Syllabuses
College of Engineering -

H.M.

(For orders)

Cs/

order No 4444. 9 July 1896.

The D.P.I's proposals are accepted in throughout. -

(P.O.)
21/7/96

To D.P.I (Q.O.) with orgl enclos. Despd 27/7/96.

24/7

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DATED

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NT FOR DESPATCH

1-4-07 ✓
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