RGPV (DIPLOMA WING) BHOPAL	OBE CURRICULUM FOR THE COURSE	FORMAT-3	Sheet No. 1/3

Branch	Cement Technology (C01)	Semester	III

Course Code	301	Course Name	Cement Chemistry

Course Outcome 1	**Student will be able to explain the chemistry of different raw materials of cement and their testing.**	Teach Hrs	Marks
Learning Outcome 1	Student will be able to define cement and classify the calcareous and argillaceous raw materials.	**08**	**10**
Contents	Cement, chemistry of raw materials used in cement manufacturing, calcareous and argillaceous materials, limestone, high grade, low grade, feed take grade, chalk, marl, clay component, iron ore (laterite), bauxite, clay, gypsum, fly ash, slag, properties of calcareous and argillaceous materials, corrective ingredients.		
Method of Assessment	Paper pen test		
Learning Outcome 2	Student will be able to identify the role of major and minor raw materials of cement.	**08**	**10**
Contents	Selection & chemical analysis of major and minor raw materials such as CaO, alumina, iron oxide, silica, alkalies, sulfur, magnesium oxide, effect of adding gypsum, auxiliary components of cement raw materials, chlorides, fluoride. P_2O_5, cement components and their effects.		
Method of Assessment	Theory exam		
Learning Outcome 3	Student will be able to determine the acidic and basic oxides, LOI, TC and MC of limestone.	**10**	**15**
Contents	Determination of acidic oxides such as SO_3, SiO_2, determination of basic oxides such as Al_2O_3, Fe_2O_3, CaO, Mgo, determination of LOI (loss on ignition), determination of total carbonate and magnesium carbonate (TC and MC).		
Method of Assessment	Laboratory test by observation		
Course Outcome 2	**Student will be able to calculate the proportion of raw materials required in preparing the raw mix and compound compositions of clinker.**	Teach Hrs	Marks
Learning Outcome 1	Student will be able to state the two, three, four component methods of raw mix design.	**8**	**10**
Contents	Different methods of raw mix design, two, three, four component designs, criteria for raw mix design, chemical composition of raw materials of cement clinker, quality control at the lime stone quarry, potential clinker composition.		
Method of Assessment	Theory exam		
Learning Outcome 2	Student will be able to specify the physical and chemical requirements of raw mix and clinker and their effects,	**8**	**10**

Contents	Physical and chemical requirements of raw mix and clinker, hydraulic modulus, silica ratio, alumina ratio, silicic acid ratio, lime saturation factor, standard lime, control of LSF, SR, AR, HM, and their effects, mineral phases of the Portland cement clinker or compound composition of clinkers (C_3S, C_2S, C_3A, C_4AF), characteristics of the compound compositions of clinker.		
Method of Assessment	Theory exam		
Learning Outcome 3	Student will be able to solve the given problems on cement modules and compound compositions of clinker.	**08**	**10**
Contents	Bogue's formula, calculation of raw mix compositions (CaO, Al_2O_3, Fe_2O_3, SiO_2), calculation of compound compositions of clinker (C_3S, C_2S, C_3A, C_4AF) and cement modules (LSF, SR, AR, HM, etc).		
Method of Assessment	Theory exam		
Course Outcome 3	**Student will be able to describe the different methods of cement manufacturing, classification, setting and hardening of cement.**	Teach Hrs	Marks
Learning Outcome 1	Student will be able to draw an overall block diagram of cement manufacturing process and explain the process with setting and hardening of cement.	**10**	**10**
Contents	Different methods of cement manufacturing, dry process, wet process, semi dry process, their advantages and disadvantages, block diagram of dry process and wet process, Setting and hardening of cement, reactions during setting and hardening, sequence of changes during setting and hardening of cement (block diagram), function of gypsum, and hydration reaction of gypsum. Setting and hardening of blended Portland cements.		
Method of Assessment	Theory exam		
Learning Outcome 2	Student will be able to categorize the different types of cement.	**10**	**10**
Contents	Different types of cement, Ordinary Portland cement (OPC), white cement, moderate heat Portland cement, rapid hardening cement, low heat cement, IRST- 40 cement, blended PC, Portland pozzolana cement, blast furnace slag cement, their properties, composition, estimation of pozzolana and slag percentage in cement.		
Method of Assessment	Paper pen test		
Course Outcome 4	**Student will be able to test the different properties of Portland cements.**	Teach Hrs	Marks
Learning Outcome 1	Student will be able to describe the different physical and chemical properties of cement.	**08**	**10**
Contents	Evaluation of physical and chemical of properties of cement, consistency, Initial and final setting time, compressive strength, soundness by Le-chatelier's method and by autoclave test, fineness by sieve analysis and by air permeability method (Blain), loss on ignition, insoluble residue, burn ability index, burn ability factor.		
Method of Assessment	Theory exam		
Learning Outcome 2	Student will be able to test the consistency, setting time, compressive strength, fineness and soundness of cement.	**10**	**15**

Contents	Determination of consistency, setting time, compressive strength, fineness and soundness of cement		
Method of Assessment	Laboratory test by observation		
Learning Outcome 3	Student will be able to determine the liter weight meter, insoluble residue and drying shrinkage.	**08**	**10**
Contents	Determination of liter weight meter, residue and drying shrinkage.		
Method of Assessment	Laboratory test by observation		
Learning Outcome 4	Student will be able to follow safety precautions while performing experiments.	**02**	**05**
Contents	Instructions related with safety precautions during experiments.		
Method of Assessment	Laboratory test by observation		
Course Outcome 5	**Student will be able to explain the Pyro Processing, fuels used in cement plant and their analysis.**	Teach Hrs	Marks
Learning Outcome 1	Student will be able to define the Pyro processing with chemical reactions during clinker burning and describe the proximate and ultimate analysis of coal.	**10**	**10**
Contents	Pyro Processing in kiln section, Reaction of clinkerisation process at different temperature in the preheater and kiln (chemical transformation). Flow of raw materials and hot gases in Kiln section, specifications of kiln. Classification of fuels, characteristics of good fuel, analysis of coal, proximate analysis, ultimate analysis, orsat gas analysis.		
Method of Assessment	Theory exam		
Learning Outcome 2	Student will be able to calculate the calorific value of coal by bomb calorimeter.	**04**	**05**
Contents	Calculation of calorific value of coal by using bomb calorimeter.		
Method of Assessment	Laboratory test by observation		
Learning Outcome 3	Student will be able to solve given problems of air requirement for the combustion process.	**08**	**10**
Contents	Calculations of air requirements, analysis of coal, simple numerical problems on combustion calculation, on dry air basis, on moisture received basis, on ash free basis.		
Method of Assessment	Theory exam		

LIST OF EXPERIMENTS

Practical: **2** Hrs. per week

S. No.	Title of Experiments
1.	Determination of acidic oxides (So3, Sio2).
2.	Determination of Basic oxides (Al2o3, Fe2o3, Cao, Mgo).
3.	Determination of loss on ignition.
4.	Determination of total carbonate and magnesium carbonate (TC and MC).
5.	Determination of consistency.
6.	Determination of initial and final setting time.
7.	Determination of Compressive strength.
8.	Determination of fineness by sieving.
9.	Determination of fineness by Blain.
10.	Determination of Insoluble residue.
11.	Determination of soundness by Le Chtalier's expansion.
12.	Determination of soundness by Autoclave expansion.
13.	Determination of litre weight meter
14.	Determination of drying shrinkage.
15.	Determination of calorific value of coal by bomb calorimeter.