MOHAMED SATHAK A J COLLEGE OF ENGINEERING

Siruseri IT park, OMR, Chennai - 603103

| | | | LESSON PI | LAN | | | | |
|--------------------|-------------|---|--------------------------------------|---------------------|---|-------------------------|--------------|-------------|
| | | De | epartment of Civil F | Ingineering | 5 | | | |
| Name of Subject | | FOUNDATION ENGINEE | RING | Name o handlin | f the g Faculty | Mr. Rakhesh Ra | marajan | |
| Subject | Code | CE8591 | | Year | / Sem | III / V | | |
| Academ | nic Year | 2022-2023 | | Ba | tch | 2020-202 | 4 | |
| | | | Course Obje | ctive | | | | |
| | | on common method of sub soil investigation select and design a suitable foundation. | and design of founda | tion. At the | end of this course st | udent acquires the capa | city to inve | stigate the |
| | | | Course Outc | ome | | | | |
| | | 1. Describe various method | ds involved in sub soi Techniques | | on, Sampler and Sam | pling | | |
| | | 2.Design the fo | oundation based on th | e bearing ca | apacity of soil | | | |
| | | 3. Analyze to Carry of | out various test involv | ed in settle | ment of foundation | | | |
| | | 4. Apply the suitab | le type of footing for | different lo | ading conditions. | | | |
| | | 5. Analyze | various pressure acti | _ | ning walls | | | |
| | | | Lesson Pla | n T | Γ | т | Γ | ı |
| Sl. No. | | Topic(s) | T / R* Book | Periods Required | Mode of Teaching (BB / PPT / NPTEL MOOC / etc.) | | со | PO |
| UNIT I | SITE IN | VESTIGATION AND SELECTION | N OF FOUNDAT | ΓION | <u> </u> | Į. | | |
| 1 | Scope a | and objectives, Methods of exploration | Т3 | 1 | PPT | L1 | CO1 | PO1 |
| 2 | Augurii | ng and boring, Wash boring and rotary drilling | Т3 | 1 | вв, ррт | L2 | CO1 | PO1 |
| 3 | Dep | oth of boring, spacing of bore hole | Т3 | 1 | ВВ, РРТ | L2 | CO1 | PO2 |
| 4 | | oling techniques, Representative and undisturbed sampling, Methods | R3 | 1 | вв, ррт | L3 | CO1 | PO3 |
| 5 | Split spoo | on sampler, thin wall sampler, Stationery piston sampler | R3 | 2 | ВВ, РРТ | L3 | CO1 | PO3 |
| 6 | Penetrati | on tests (SPT and SCPT), Bore log report | Т3 | 1 | вв, ррт | L1 | CO1 | PO2 |
| 7 | par | Data interpretation, strength ameters and Liquefaction potential | Т3 | 1 | вв, ррт | L2 | CO1 | PO2 |
| 8 | Selectio | n of foundation based on soil condition. | Т3 | 1 | ВВ, РРТ | L1 | CO1 | PO1 |
| Suggeste | d Activity: | Quiz | | | | | | |
| Evaluatio | on method: | 10 Questions, each carry 1 mark | | | | | | |
| UNIT I | I SHALL | OW FOUNDATION | | | | | | |
| 9 | Introdu | ction, Location and depth of foundation Codal provisions | R3 | 1 | PPT | L1 | CO2 | PO1 |
| 10 | beari | ng capacity of shallow foundation on homogeneous deposits | R3 | 1 | ВВ, РРТ | L1 | CO2 | PO2 |
| 11 | | chi's formula and BIS formula, factors fecting bearing capacity, problems | R3 | 1 | BB, PPT | L3 | CO2 | PO2 |

| 12 | Bearing capacity from in-situ tests (SPT, SCPT and plate load) Allowable bearing pressure | R3 | 1 | ВВ, РРТ | L2 | CO2 | PO3 |
|-----------|--|----|---|---------|----|----------|-----|
| 13 | Seismic considerations in bearing capacity evaluation | R3 | 2 | ВВ, РРТ | L3 | CO2 | PO2 |
| 14 | Determination of Settlement of foundations on granular and clay deposits | R3 | 1 | вв, ррт | L2 | CO2 | PO3 |
| 15 | Total and differential settlement, Allowable settlements | R3 | 1 | ВВ, РРТ | L2 | CO2 | PO1 |
| 16 | Codal provision, Methods of minimizing total and differential settlements. | R3 | 1 | ВВ, РРТ | L1 | CO2 | PO1 |
| Suggested | d Activity: Assignment (Bearing capacity Problem) | | | | | <u>I</u> | |
| Evaluatio | on method: Paper Based | | | | | | |
| UNIT I | II FOOTINGS AND RAFTS | | | | | | |
| 17 | Types of footings | R3 | 1 | ВВ | L1 | CO4 | PO1 |
| 18 | Distinction between Igneous, Sedimentary and Metamorphic rocks. | R3 | 1 | BB | L4 | CO3 | PO1 |
| 19 | Contact pressure distribution: Isolated footing | R3 | 1 | BB | L3 | CO3 | PO3 |
| 20 | Combined footings | R3 | 1 | BB | L2 | CO3 | PO2 |
| 21 | Types and proportioning | R3 | 1 | BB | L1 | CO3 | PO3 |
| 22 | Mat foundation, Types and applications | R3 | 2 | BB | L1 | CO3 | PO2 |
| 23 | Proportioning, Floating foundation | R3 | 1 | BB | L2 | CO3 | PO2 |
| 24 | Seismic force consideration, Codal Provision | R3 | 1 | BB | L2 | CO3 | PO1 |
| Suggested | d Activity: Assignment (Design of foundation) | | | | | I | |
| Evaluatio | on method: Paper Based | | | | | | |
| UNIT I | V PILE FOUNDATION | | | | | | |
| 25 | Types of piles and their function, Factors influencing the selection of pile | R3 | 1 | BB, PPT | L1 | CO4 | PO1 |
| 26 | Carrying capacity of single pile in granular and cohesive soil, static formula | R3 | 1 | BB | L1 | CO4 | PO1 |
| 27 | dynamic formulae (Engineering news and Hileys), Capacity from in-situ tests (SPT and SCPT) | R3 | 2 | BB | L2 | CO4 | PO2 |
| 28 | Negative skin friction, uplift capacity, Group capacity by different methods (Feld's rule, Converse, Labarra formula and block failure criterion) | R3 | 2 | ВВ | L3 | CO4 | PO3 |
| 29 | Settlement of pile groups, Interpretation of pile load test (routine test only), Under reamed piles | R3 | 2 | ВВ | L2 | CO4 | PO2 |
| 30 | Capacity under compression and uplift. | R3 | 1 | BB | L1 | CO4 | PO1 |
| Suggestee | d Activity: Quiz | | | | | | |
| Evaluatio | on method: 10 Questions, each carry 1 mark | | | | | | |
| UNIT V | RETAINING WALLS | | | | | | |
| 31 | Plastic equilibrium in soils, active and passive states | R3 | 2 | BB | L1 | CO5 | PO1 |
| 32 | Rankine's theory, cohesionless and cohesive soil | R3 | 1 | BB | L1 | CO5 | PO2 |
| 33 | Coulomb's wedge theory | R3 | 1 | BB | L1 | CO5 | PO2 |
| | | | | | | | |

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|-----------|--|--|---------------|----------------------|------------------------|--------------------------|--------------|-------------|-------------|-------------------|------------------|--|
| 34 | 1 | n for critical failure plane, Earth pressure taining walls of simple configurations | F | R3 | 2 | В | В | ı | 2.2 | CO5 | PO3 | |
| 35 | | Culmann Graphical method | F | 23 | 1 | В | В | I | 2 | CO5 | PO1 | |
| 36 | pressu | re on the wall due to line load, Stability analysis of retaining walls. | F | R3 | 2 | В | В | I | L3 | CO5 | PO1 | |
| Suggestee | d Activity: | Case Studies | | | | | | | | | | |
| Evaluatio | on method: | Slope Stability | | | | | | | | | | |
| Content I | Beyond the | Syllabus Planned | | | | | | | | | | |
| 1 | | | To | ols used to | design Da | ım | | | | | | |
| 2 | | | Tool | s used in F | Remote sen | sing | | | | | | |
| | | | | ext Book | | | | | | | | |
| 1 | | Murthy, V.N.S., "Soi | | | dation En New Delh | | , CBS Pub | olishers an | d | | | |
| 2 | Gopal Ranjan and Rao A.S.R. "Basic and Applied soil mechanics", New Age International Pvt. Ltd, New Delhi, 2005 | | | | | | | | | | | |
| 3 | | Purushothama Raj. P., " | Soil Mechai | | oundation on, 2013 | Engineerin | ıg", 2nd E | dition, Pea | ırson | | | |
| 4 | | Varghese, P.C.," Found | lation Engin | eering", P Delhi, | | ll of India | Private Li | mited, Nev | v | | | |
| | | | Ref | erence Bo | oks | | | | | | | |
| 1 | | Das, B.M. "Principles of Found | ation Engin | neering" 5 | th edition, T | Thompson . | Asia Pvt. | Ltd., Singa | pore, 2003 | 3. | | |
| 2 | Kanir | aj, S.R. "Design aids in Soil Mechanics ar | ıd Foundati | on Engine | ering", Ta | ta Mc Gra | w Hill Pu | blishing co | mpany Lt | d., New De | elhi, 2002. | |
| 3 | | Punmia, B.C. "Soil Mecha | nics and Fo | undations | ", Laxmi P | ublications | s Pvt. Ltd | ., New Dell | ni,2005 | | | |
| 4 | Ven | katramaiah, C. "Geotechnical Engineeri | ng", New A | ge Interna | tional Pub | lishers, Ne | wDelhi, 2 | 007 (Repri | nt) | | | |
| 5 | | Arora K.R. "Soil Mechanics a | nd Founda | tion Engin | eering", S | tandard Pu | ıblishers a | and Distrik | outors, Ne | w Delhi, 20 | 05. | |
| 6 | | IS 6403: 1981 (Reaffirmed 1997) "I | Breaking ca | pacity of s | hallow fou | ndation", l | Bureau of | Indian St | andards, N | New Delhi, | 1998 | |
| 7 | IS8009 (1 | Part1):1976 (Reaffirmed 1998) "Shallow | foundations | | l to symme hi, 1999 | trical statio | c vertical l | oads", Bu | reau of Inc | dian Standa | ards, New | |
| 8 | IS8009 (| Part2):1980 (Reaffirmed 1995) "Deep fou | ndations su | | symmetrio hi, 1992 | cal static ve | ertical loa | ding", Bur | eau of Ind | ian Standa | ırds, New | |
| 9 | | IS2911(Part1):1979 (Reaffirn | ned 1997) "(| Concrete I | Piles" Bure | au of India | ın Standaı | rds, New D | elhi, 1994 | | | |
| 10 | | IS2911(Part2):1979 (Reaffire | ned 1997) " | Timber Pi | iles", Bure | au of India | n Standar | ds, New D | elhi, 2007 | | | |
| 11 | | IS2911(Part 3):1979 (Reaffirmed | l 1997) "Un | der Ream | ed Piles", I | Bureau of I | ndian Sta | ndards, No | ew Delhi, 1 | 1998 | | |
| 12 | | IS2911 (Part 4) :1979 (Reaffirme | ed 1997) "Lo | oad Test o | n Piles", B | ureau of In | idian Star | dards, Ne | w Delhi, 1 | 997 | | |
| | | | Website / | | | | | | | | | |
| 1 | | | ://nptel.ac | | | | | | | | | |
| | | | ://nptel.ac | , | | , | | | | | | |
| 2 | | https://easyer | | | | tion-engir | neering-b | OOKS/ | | | | |
| | Laval 1 (I | 1): Remembering | l BI | ooms Lev | | evel 4 (L4) | . Anolyz | dua | | 1 | l | |
| | ` | Lower | Fixed | | | vel 4 (L4) vel 5 (L5) | | | | Higher | Projects / | |
| | ` | 2): Understanding Order (L3): Applying Thinking | Hour Exams | | | evel 6 (L6) | | | | Order Thinking | Mini Projects | |
| | | Mapping syllabus with Bloo | m'e Tava | nomy I | | | | | | | | |
| IIni | it No | Unit Name | L1 | L2 | L3 | L4 | L5 | L6 | LOT | НОТ | Total | |
| | nit 1 | SITE INVESTIGATION AND SELECTION | 3 | 3 | 2 | 1.4 | L3 | LO | 8 | 0 | 8 | |
| | nit 2 | OF FOUNDATION SHALLOW FOUNDATION | 3 | 3 | 2 | | | | 8 | 0 | 8 | |
| | | | | | <u> </u> | | | | L | ľ | | |

| | nit 3 | F | OOTINGS | AND RAF | TS | 3 | 3 | 1 | 1 | | | 7 | 1 | 8 |
|------------------|---|---|--|--|--|---|--|---|--|---|---|---|---|--|
| Ur | Unit 4 PILE FOUNDATION | | | | | 3 | 2 | 1 | | | | 6 | 0 | 6 |
| Uı | Unit 5 RETAINING WALLS | | | | 3 | 2 | 1 | | | | 6 | 0 | 6 | |
| Total | | | | | | 15 | 13 | 7 | | | | 35 | 1 | 36 |
| Total Percentage | | | | | 41.66667 | 36.11111 | 19.44444 | | | | 97.22222 | 2.77778 | 100 | |
| | | | | | | СО | PO Mappi | ing | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | 2 | | | | | | | | | | 2 | |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 2 | |
| CO3 | 3 | 2 | 2 | | | | | | | | | | 2 | |
| CO4 | 3 | 2 | 2 | | | | | | | | | | 2 | |
| CO5 | 3 | 2 | 2 | | | | | | | | | | 2 | |
| Avg | 3 | 2.2 | 1.8 | | | | | | | | | | 2 | |
| | <u> </u> | | | | J | ustification | for CO-P | O mapping | <u> </u> | | | | | |
| CO2 | foundation in l | on on homo | geneous d | leposits, To luation PC | of minimizi erzaghi's fo 03: Design/ rmination (| rmula and developme | BIS formunt of solut | ıla, factors | affecting | bearing ca city from i | pacity, pr in-situ test | oblems,Sei | smic consi | |
| | load)All | owable bea | aring pres | | | or settleme | ent of found Sallow fo | dations on | | and clay d | eposits. T | SO1: Susta | | |
| CO3 | PO1 considera | : Engineer | ring know | ledge in Ty n PO2 : Pr | ypes of foot oblem anal ment of sol | ings, Distii ysis in Con | Sallow for nction between bined foo | dations on undation veen Igneo tings, Mat | granular us, Sedim foundatio | entary and | d Metamo | rphic rock | s, Seismic | ition for force Floatin |
| | PO1 considera fo PO1 : En granular news a | : Engineer ation ,Coda undation l gineering and cohes and Hileys) | ring know al Provision PO3:Design knowledgn ive soil, standard ,Capacity PO3:Desi | ledge in Tyn PO2 : Pr gn/develop e in Types atic formu from insid gn/develoj | ypes of foot | ings, Distin ysis in Con utions in T d their fun ty under co Γ and SCP lutions in N | Sallow for nction between the property of the property of the property of the | dations on undation veen Igneo tings, Mat proportioni tors influer and uplif tent of pile in friction | granular us, Sedim foundatio ing. PSO1 ncing the s t. PO2 : P groups, I ,uplift cap | entary and n ,Types a : Sustainal selection of roblem an nterpretat pacity, Gro | d Metamo nd applica ble solutio f pile, Car alysis indy ion of pile up capaci | rphic rock tions,Prop n for Foot rying capa ynamic for load test (| s, Seismic cortioning ing and raf city of sing mulae (En routine tes | force Floating ts gle pile i gineering t only), |
| CO3 | PO1 : En granular news at Under res | : Engineer tion ,Coda undation l gineering and cohes and Hileys) amed piles rul | ring know all Provision PO3:Design knowledgnive soil, st: ,Capacity PO3:Desine, Conversion | ledge in Tyn PO2 : Pr gn/develop e in Types atic formu from insit gn/develop se , Labarr e in Plastio f retaining | ypes of foot oblem anal ment of sol of piles an la , Capaci u tests (SP' oment of so ra formula e equilibriu g walls. PO utions in C | ings, Distin ysis in Con utions in T d their fun ty under co T and SCP lutions in N and block to m in soils, a 2 : Problen | Sallow for nction between the property of the types and proceedings and proceedings and proceedings and proceedings are the pr | dations on undation ween Igneo tings, Mat proportionic and uplifuent of pile in friction terion), PSG passive stain Ranking ailure plan | granular us, Sedim foundatio ing. PSO1 neing the s t. PO2 : P groups, I gruplift cap O1: Susta tes, Culm c's theory, e, Earth p | entary and n ,Types a : Sustainal selection of roblem an nterpretat sacity, Gro inable solu ann Graph cohesionleressure on | I Metamo nd applica ble solutio f pile, Car alysis indy ion of pile up capacition for phical methess and co | rphic rock tions,Prop n for Foot rying capa ynamic for load test (ty by differ ile foundar od,pressur hesive soil | s, Seismic cortioning and rafectly of sing mulae (En routine testent methodion teen the way, Coulomb | force Floating gle pile i gineering t only), ds (Feld |
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| CO3 | PO1 : En granular news an Under res | : Engineer tion ,Coda undation l gineering and cohes and Hileys) amed piles rul- ngineering ,Stability O3 :Design | ring known of Provision Provision Provision Provision knowledge analysis on development of the Provision P | ledge in Tyn PO2 : Pr n PO2 : Pr gn/develop e in Types atic formu from insit gn/develop se , Labari e in Plastic f retaining ment of sol | ypes of foot oblem anal ment of sol of piles an la , Capaci u tests (SP oment of so ra formula e equilibriu g walls. PO utions in C | ings, Distin ysis in Con utions in T d their fun- ty under co T and SCP lutions in N and block to m in soils, a 2: Problen ondition fo D1: Sustain | Sallow for nction between the procession of the | dations on undation ween Igneo tings, Mat or oportionic and uplifuent of pile in friction terion), PSopassive statin Ranking ailure plantion for Ret | granular us, Sedim foundatio ing. PSO1 ncing the s t. PO2 : P groups, I ,uplift cap O1: Susta tes, Culm c's theory, e, Earth p taining W | entary and n ,Types a : Sustainal selection of roblem an nterpretat pacity, Gro inable solu ann Graph cohesionle ressure on alls | d Metamo nd applica ble solutio f pile, Car alysis indy ion of pile up capaci ition for p nical meth ess and co retaining | rphic rock tions,Prop n for Foot rying capa ynamic for load test (ty by differ ile foundar od,pressur hesive soil | s, Seismic portioning and rafectly of sing mulae (En routine testent methodion ee on the way, Coulomb mple config | force Floating Gle pile in gineering Gle (Feld |
| CO3 CO4 | PO1 : En granular news an Under res | : Engineer tion ,Coda undation l gineering and cohes and Hileys) amed piles rul gineering l ,Stability O3 :Design | ring known of Provision of Prov | ledge in Tyn PO2 : Pr n PO2 : Pr gn/develop e in Types atic formu from insit gn/develop se , Labari e in Plastic f retaining ment of sol | ypes of foot oblem anal ment of sol of piles an la , Capaci u tests (SP oment of so ra formula e equilibriu g walls. PO utions in C | ings, Distin ysis in Con utions in T d their fun- ty under co T and SCP lutions in N and block to m in soils, a 2: Problen ondition fo D1: Sustain | Sallow for nction between the procession of the | dations on undation ween Igneo tings, Mat or oportionic and uplifuent of pile in friction terion), PSopassive statin Ranking ailure plantion for Ret | granular us, Sedim foundatio ing. PSO1 ncing the s t. PO2 : P groups, I ,uplift cap O1: Susta tes, Culm c's theory, e, Earth p taining W | entary and n ,Types a : Sustainal selection of roblem an nterpretat pacity, Gro inable solu ann Graph cohesionle ressure on alls | d Metamo nd applica ble solutio f pile, Car alysis indy ion of pile up capaci ition for p nical meth ess and co retaining | rphic rock tions,Prop n for Foot rying capa ynamic for load test (ty by differ ile foundar od,pressur hesive soil | s, Seismic portioning and rafectly of sing mulae (En routine testent methodion ee on the way, Coulomb mple config | force Floating te pile gineering tonly), ds (Feld |
| CO3 | PO1 : En granular news an Under res | : Engineer tion ,Coda undation l gineering and cohes and Hileys) amed piles rul- ngineering ,Stability O3 :Design | ring known of Provision Provision Provision Provision knowledge analysis on development of the Provision P | ledge in Tyn PO2 : Pr n PO2 : Pr gn/develop e in Types atic formu from insit gn/develop se , Labari e in Plastic f retaining ment of sol | ypes of foot oblem anal ment of sol of piles an la , Capaci u tests (SP oment of so ra formula e equilibriu g walls. PO utions in C | ings, Distin ysis in Con utions in T d their fun- ty under co T and SCP lutions in N and block to m in soils, a 2: Problen ondition fo D1: Sustain | Sallow for nction between the procession of the | dations on undation ween Igneo tings, Mat or oportionic and uplifuent of pile in friction terion), PSopassive statin Ranking ailure plantion for Ret | granular us, Sedim foundatio ing. PSO1 ncing the s t. PO2 : P groups, I ,uplift cap O1: Susta tes, Culm c's theory, e, Earth p taining W | entary and n ,Types a : Sustainal selection of roblem an nterpretat pacity, Gro inable solu ann Graph cohesionle ressure on alls | d Metamo nd applica ble solutio f pile, Car alysis indy ion of pile up capaci ition for p nical meth ess and co retaining | rphic rock tions,Prop n for Foot rying capa ynamic for load test (ty by differ ile foundar od,pressur hesive soil | s, Seismic portioning and rafectly of sing mulae (En routine testent methodion ee on the way, Coulomb mple config | fo Fits |