

| Marks | Grade Point | Letter Grade | Marks | Grade Point | Letter Grade |
|-------|-------------|--------------|-------|-------------|--------------|
| 80> | 4.00 | A+ | 55-59 | 2.75 | B- |
| 75-79 | 3.75 | A | 50-54 | 2.50 | C+ |
| 70-74 | 3.50 | A- | 45-49 | 2.25 | C |
| 65-69 | 3.25 | B+ | 40-44 | 2.00 | D |
| 60-64 | 3.00 | B | 0-39 | 0.00 | F |

Daffodil Polytechnic Institute, Institute Code: 50238

Lesson Plan – Academic session: JAN 2024 to JUN 2024

Subject Teacher : Rubel Hossen
: Instructor, Electrical Technology.
Subject Name : DC Machines
Subject Code : 26753
Technology : Telecommunication
Semester : 5th
BTEB Text Book Name : (Publisher: RS PUBLICATION)

| Class Timing Distribution | |
|---|------------|
| Particulars | Time |
| Greeting with students | 10 Minutes |
| Previous Class Review | 10 Minutes |
| Present Class Topic Discussion and Lecture Delivery | 60 Minutes |
| Present Class Topics Review | 10 Minutes |

| Mark Distribution (for 150 Marks) | | | |
|-----------------------------------|------------|-----------------|-----------|
| Theory Marks | | Practical Marks | |
| Midterm | 30 | PC | 25 |
| Class test | 20 | PF | 25 |
| Quiz test | 10 | - | - |
| Final | 90 | - | - |
| Total | 150 | Total | 50 |

AIMS

To provide the student with an opportunity to acquire knowledge, skill and attitude in the area of DC Machines with special emphasis on:

Diploma in Engineering Level students are required to acquire the knowledge and skill on the area of DC Machines with special emphasis of basic concept of Cell & Battery, Fuel cell, procedure of Battery charging and testing, DC generator and its characteristics, Losses and Efficiency of DC generator, DC motor, Speed

control and voltage regulation of DC motor, Industrial Application of DC motor, electric traction. Electrical machines is a subject where a student will deal with various types of electrical machines which are employed in industries, power stations, domestic and commercial appliances etc. As such the knowledge of DC Machine the prerequisite for these fields for effective discharge of their duties. These necessities of electrical engineering subjects in the curriculum of Diploma in engineering. After completion of this course student will be able to construct Cell & Battery, Perform Battery charging and testing, assemble and re-assemble of DC Generator, Operate DC generator and motor, develop lap and wave winding and speed control of DC motor. Have been given more emphasis on practical aspects rather than theory in teaching learning approaches

Learning Outcome (Theoretical)

After Completing the subject, students will be able to:

- Define cell, fuel cell and battery.
- Illustrate procedure of Battery charging and testing.
- Outline DC generator and its characteristics.
- Enumerate Speed control and Regulation of DC motor
- Explain Industrial Application of DC motor.
- Mention electric traction
- Outline DC generator and its characteristics.

Learning Outcome (Practical)

After undergoing the subject, students will be able to:

- Construct cell, fuel cell and battery.
- Perform Battery charging and testing.
- Assemble and disassemble various parts of D.C. Generator
- Operate DC shunt, series and compound motors
- Execute speed control on DC Motors.
- Demonstrate Industrial Application of DC motor.
- Develop Lap and wave winding.

| Date | Lecture | Chapter/ Exam / Industrial Visit | Learning Area | Learning Outcome | Class/Lab Supporting Equipments |
|------|---------|---|---|--|---|
| | 1. | Understand the construction of different types of cell and battery. | 1.1 Describe the construction of a dry cell and its chemical reaction. 1.2 Illustrate the construction of alkaline batteries. 1.3 Describe the construction of lead acid battery and its chemical reaction. | After the Class, Students will be able to know ✓ construction of dry cell ✓ construction of lead acid battery After the Class, Students will be able to Know construction of alkaline batteries. | Basic Class Materials & Projector, Dry cell YouTube link: https://www.youtube.com/watch?v=UEPJXSXw7HA |
| | 2. | Understand the features of battery charging. | 2.1 Name the types of battery charging system. 2.2 Describe the charging procedure of the battery by 220-230VAC source. 2.3 Explain the procedure of slow charging. 2.4 Describe the procedure of quick charging. | After the Class, ✓ Students will be able to know different types of battery charging. ✓ They will be able to explain the procedure of slow & quick charging. | Basic Class Materials & Projector, lead acid battery 12 |
| | 3. | Understand the features of battery charging. | 2.5 Describe the procedure of preparing electrolytes. 2.6 Outline the construction of a dry charged battery. 2.7 Explain the charging procedure of sulfated batteries. 2.8 Describe the process of charging more than one battery at a time. | After the Class, ✓ Students will be able to know about the construction of dry charged batteries. ✓ They will be able to charge the procedure of a sulfated battery. | Basic Class Materials & Projector, Dry cell YouTube link: https://www.youtube.com/watch?v=3wLJLm0QLpg |

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| 4. | Practical 0 1 | MAKE A VOLTAIC CELL | <p>After the Class</p> <p>Students will be able learn about the followings materials</p> <p>Collect tools and necessary materials for making a voltaic cell.</p> <p>Sketch the connection diagram.</p> <p>Connect all components according to the diagram.</p> <p>Observe the chemical reaction.</p> <p>Measure the output voltage.</p> <p>Maintain the record of performed tasks.</p> | Must be submitted within two classes |
| 5. | Understand the process of electroplating. | <p>4.1 State fundamental principles of electroplating.</p> <p>4.2 State Faraday's laws of electrolysis.</p> <p>4.3 Describe briefly the process of extraction and refining of metals.</p> <p>4.4 State a simple method of producing copper plating upon a carbon brush.</p> <p>4.5 Describe electro-deposition process.</p> <p>4.6 Identify power supply for electrolytic processes adopted in electroplating.</p> | <p>After the Class,</p> <p>✓ Students will be able to know the principles of electroplating.</p> <p>✓ Students will be able to know Faraday's laws of electrolysis.</p> <p>✓ They will be able to derive a simple method of producing copper plating upon a carbon brush.</p> | <p>Basic Class Materials & Projector, copper plate</p> <p>YouTube link: https://www.youtube.com/watch?v=OxhCU_jBIOA</p> |

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| 6. | Understand the working principle of DC generators. | <p>5.1 State generator principle.</p> <p>5.2 Mention the types or Classification of DC generators.</p> <p>5.3 Mention the conditions for generation of emf in a single coil generator.</p> <p>5.4 Describe the constructional details of a DC generator.</p> <p>5.5 Explain the functions of different parts/components of a DC generator.</p> <p>5.6 Sketch the magnetic circuit of a DC generator.</p> | <p>After the Class,</p> <p>✓ Students will be able to know about the generator principle.</p> <p>✓ They will be able to construct the details of a DC generator.</p> <p>✓ Students will be able to know components of a DC generator.</p> | Basic Class Materials & Projector, lather wet paper |
| 7. | Assignment - 01 | Chapter: 01,02,03 | | Must be submitted within two classes |
| 8. | Understand the working principle of DC generators. | <p>5.7 Express the deduction of the e.m.f equation of a DC generator.</p> <p>5.8 List the various losses in a DC generator.</p> <p>5.9 Explain power stages of a DC generator.</p> <p>5.10 Express the condition for maximum efficiency.</p> <p>5.11 Solve problems relating to DC generators.</p> | <p>After the Class,</p> <p>✓ Students will be able to explain various losses in a DC generator</p> <p>✓ They will be able to condition for maximum efficiency.</p> | <p>Basic Class Materials & Projector,</p> <p>YouTube link: https://www.youtube.com/watch?v=-xebh8wU8gY </p> |
| 9. | Practical 02 | PERFORM CHARGE A LEAD ACID BATTERY. | <p>After the Class</p> <p>Students will be able learn about the followings materials</p> <p>Sketch the connection diagram for constant potential/Constant current method of charging.</p> <p>Identify the equipment and materials for charging a lead acid battery.</p> <p>Record the readings by measuring the terminal</p> | Must be submitted within two classes |

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| | | | | <p>voltage of the discharged battery and specific gravity of electrolytes.</p> <p>Connect the positive and negative terminal of the battery to the positive and negative terminals of the charger respectively.</p> <p>Set the charging voltage and switch on the charger.</p> | |
| | 10. | Review Class | Review Class of Lecture 1,2,3 , (Regarding students problem) | Through the review class, students can solve their problem | Basic Class Materials |
| | 11. | Quiz Test 1 | Examination Topic: Chapter 1,2,3 , Examination mark: 10 Passing Mark: 04 | Through the Quiz Test students will learn intellectual intelligence on the topics discussed. | <p>1) Basic Class Materials</p> <p>2) Examination Kata</p> |
| | 12. | Class Test 1 | Examination Topic: Chapter 1,2,3 Examination mark: 10 Passing Mark: 04 | Through class tests students will learn to evaluate themselves on their own | <p>1) Basic Class Materials</p> <p>2) Examination Kata</p> |
| | 13. | Understand the principle of winding of DC generators. | <p>6.1 Define the terms pole pitch, coil pitch, front pitch, back pitch, average pitch and commutation pitch.</p> <p>6.2 Describe lap and wave winding.</p> <p>6.3 Sketch the developed diagram of simplex and duplex (lap and wave) winding.</p> <p>6.4 Name at least four major differences between the lap and wave windings</p> | <p>After the Class,</p> <p>✓ They will know about the principle of winding of DC generators.</p> <p>✓ Student Will be able to know major differences between the lap and wave windings</p> | <p>Basic Class Materials & Projector, super enamel wire</p> <p>YouTube link: https://www.youtube.com/results?search_query=lap+and+wave+windings+ </p> |

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| | 14. | Practical 03 | MEASURE THE INTERNAL RESISTANCE OF A BATTERY. | <p>After the Class</p> <p>Students will be able learn about the followings materials</p> <p>Sketch necessary circuit diagram.</p> <p>Connect a resistance (known value) with the battery. Record the readings by measuring the voltage and current of the battery.</p> <p>Calculate the internal resistance of a battery</p> <p>Maintained the record of performed tasks.</p> | Must be submitted within two classes |
| | 15. | Understand the armature reaction and commutation of DC generator | <p>7.1 Explain armature reaction.</p> <p>7.2 Describe the effect of armature reaction.</p> <p>7.3 State demagnetizing and cross magnetizing.</p> <p>7.4 Explain the action of commutation.</p> | <p>After the Class,</p> <p>✓ Students will be able to know about the effect of armature reaction.</p> <p>✓ They will be able to explain the action of commutation.</p> | Basic Class Materials & Projector |
| | 16. | Assignment -02 | Chapter: 04,05,06 | | Must be submitted within two classes. |
| | 17. | Understand the armature reaction and commutation of DC generator | <p>7.5 Identify the value of reactance voltage.</p> <p>7.6 Mention the methods of improving commutation.</p> <p>7.7 Explain the necessity of interpoles and compensating winding.</p> <p>7.8 State the need for equalizing bars and rings.</p> | <p>After the Class,</p> <p>✓ Students will be able to identify the value of reactance voltage.</p> <p>✓ They can describe the need for equalizing bars and rings.</p> | Basic Class Materials & Projector |

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| 18. | Understand the principle of excitation. | 8.1 Explain the excitation of the DC generator. 8.2 Explain the necessity of excitation. 8.3 Mention self-excited and separately excited generators. 8.4 Describe the condition for excitation. | After the Class, Students will be able to explain ✓ The excitation of the DC generator. ✓ Mention self-excited and separately excited generators. ✓ The condition for excitation. | Basic Class Materials & Projector, voltage regulator | |
| 19. | Practical 04 | DISASSEMBLE AND RE-ASSEMBLE THE PARTS OF A DC GENERATOR/ DC MOTOR. | After the Class Students will be able learn about the followings materials 4.1 Select the necessary tools required for disassembling and reassembling the parts of the DC generator/ DC motor. 4.2 Identify at least ten main parts of the generator/motor. 4.3 Sketch at least ten main parts of the generator/motor. 4.4 Re-assemble the parts of the generator/motor. 4.5 Connect the generator/motor to the proper power source. 4.6 Start the generator/motor. 4.7 Maintain the record of performed task. | Must be submitted within two classes | |

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| | 20. | | | | |
| | 21. | Understand the characteristics of DC generators. | <p>9.1 Explain the process of building up the voltage of the shunt generator.</p> <p>9.2 State the critical resistance and critical speed for shunt generators.</p> <p>9.3 Plot the terminal voltage Vs load current characteristic curve of shunt generator.</p> <p>9.4 State the reasons for decreasing terminal voltage with increasing load.</p> <p>9.5 Plot the internal and external characteristic curve of DC shunt, series and compound generator.</p> <p>9.6 Solve related problems relating to shunt generator</p> | <p>After the Class,</p> <p>✓ Students will be able to know about the critical resistance and critical speed for shunt generators.</p> <p>✓ They can draw the terminal voltage Vs load current characteristic curve of the shunt generator.</p> | <p>Basic Class Materials & Projector, YouTube link: https://www.youtube.com/watch?v=zt0N0o-sb2A</p> |
| | 22. | Understand the concept of voltage regulation and efficiency of a DC generator. | <p>10.1 Explain the formula for voltage regulation of a DC generator.</p> <p>10.2 Discuss the importance of voltage regulation of DC generators.</p> <p>10.3 Solve problems relating to voltage regulation of DC generators.</p> <p>10.4 Express the formula for efficiency of a DC generator.</p> <p>10.5 Solve problems relating to efficiency of a DC generator.</p> | <p>After the Class,</p> <p>✓ Students will be able to know about the formula for voltage regulation of a DC generator.</p> <p>✓ They can express the formula for efficiency of a DC generator.</p> <p>✓ They will be able to solve problems relating to voltage regulation of DC generator.</p> | <p>Basic Class Materials & Projector</p> |
| | 23. | Review Class | Review Class of Lecture 4,5,6 (Regarding students problem) | Through the review class, students can solve their problem | Basic Class Materials |
| | 24. | Quiz Test 2 | <p>Examination Topic: Chapter 4,5,6</p> <p>Examination mark: 10</p> <p>Passing Mark: 04</p> | Through the Quiz Test students will learn intellectual intelligence on the topics discussed. | <p>3) Basic Class Materials</p> <p>4) Examination Kata</p> |

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| | 25. | Class Test 2 | Examination Topic: Chapter 4,5,6 Examination mark: 10 Passing Mark: 04 | Through class tests students will learn to evaluate themselves on their own | 3) Basic Class Materials 4) Examination Kata |
| | 26. | Exam Syllabus Review | | | |
| | 27. | Understand the principle of parallel operation of DC generators. | 11.1 State the need for parallel operation of DC generator (shunt, series and compound) 11.2 List the conditions for parallel operation of a DC generator. 11.3 Discuss the condition of sharing loads in DC generators operating in parallel. 11.4 Draw the circuit diagram of two long shunt compound generators connected in parallel. 11.5 Calculate the load shared by an individual machine at the time of parallel operation. | After the Class, ✓ Students will be able to know about the conditions for parallel operation of DC generators. ✓ They will be able to calculate the load shared by individual machines at the time of parallel operation. | Basic Class Materials & Projector YouTube link: https://www.youtube.com/watch?v=Jh167TEECBk |
| | 28. | Understand the working principle of DC motors. | 12.1 Explain the working principle of DC motors. 12.2 Mention the types or Classification of DC Motor. 12.3 Explain generator action of motor. 12.4 Explain the significance of the back emf. | After the Class, ✓ Students will be able to know about the working principle and Classification of DC motors. | Basic Class Materials & Projector, mini DC motor 12v |
| | 29. | Understand the Working principle of DC motor. | 12.5 Express the deduction of voltage equation of motor. 12.6 Define the term torque (mentioning its unit), running torque and break down torque. 12.7 Express the deduction of the equation for speed of DC motor (for series and shunt motors). 12.8 Plot the torque/speed curve of series, shunt and compound motors. | After the Class, ✓ Students will be able to know about the deduction of the voltage equation of the motor. ✓ They will plot the torque/speed curve of | Basic Class Materials & Projector, mini DC motor 12v YouTube link: https://www.youtube.com/watch?v=Jh167TEECBk |

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| | | | | series, shunt and compound motors. | |
| | 30. | Practical 05 | DEVELOP 4 POLES, 24 SLOTS; DOUBLE LAYER LAP WINDING (SIMPLEX & DUPLEX) OF A DC GENERATOR | <p>After the Class</p> <p>Students will be able learn about the followings materials</p> <p>Select pole pitch, back pitch, front pitch and commutator pitch for the generator.</p> <p>Sketch the developed winding diagram (simplex and duplex) showing the position of carbon brushes.</p> | Must be submitted within two classes |
| | 31. | Assignment -03 | Chapter: 7,8,9,10 | | Must be submitted within two classes |
| | 32. | Understand losses and efficiency. | <p>13.1 State the losses in DC motors.</p> <p>13.2 Calculate the efficiency of a DC motor from a given data.</p> <p>13.3 Explain the power stages of DC motors.</p> <p>10.11 Solve problems related to slip</p> | <p>After the Class,</p> <p>✓ Students will be able to know about the losses in DC motors.</p> <p>✓ They will be able to solve problems related to slip</p> | Basic Class Materials & Projector, cotton tap |

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| 33. | Understand the starting methods and speed control of the DC motor. | <p>14.1 Describe the factors controlling the speed of a DC motor.</p> <p>14.2 Discuss the general methods of speed control of DC motors.</p> <p>14.3 Explain speed control of shunt, series and compound motor.</p> <p>14.4 Mention the merits and demerits of rheostat control method.</p> <p>14.5 Describe electric braking of shunt and series motor.</p> | <p>After the Class,</p> <p>✓ Students will be able to know about the factors controlling the speed of DC motors.</p> <p>✓</p> <p>✓ Students will be able to know speed control of the shunt, series and compound motor.</p> | Basic Class Materials & Projector, Ammeter |
| 34. | Practical 06 | DETERMINE GENERATED EMF OF A DC SHUNT GENERATOR. | <p>After the Class</p> <p>Students will be able learn about the followings material</p> <p>Sketch the required diagram of the shunt generator.</p> <p>Set the experiment as per diagram.</p> <p>Start the generating set and build up the voltage.</p> <p>Measure the developed emf by starting the generator.</p> <p>Record the required data</p> | Must be submitted within two classes |
| 35. | Understand the starting methods and speed control of the DC motor. | <p>14.6 Explain the necessity of a starter for DC motors.</p> <p>14.7 Describe three point and four point starters used in DC motors.</p> <p>14.8 Explain the heating and cooling of the DC machine.</p> <p>14.9 Explain brake test and no-load test of DC motor.</p> | <p>After the Class,</p> <p>✓ Students will be able to explain the necessity of a starter for DC motors.</p> | <p>Basic Class Materials & Projector,</p> <p>YouTube link: https://www.youtube.com/watch?v=ol-O9FCDqmg </p> |

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| | | | | ✓ The will be able to know the heating and cooling of DC machine | |
| | 36. | Review Class | Review Class of Lecture 7,8,9 , (Regarding students problem) | Through the review class, students can solve their problem | Basic Class Materials |
| | 37. | Quiz Test 3 | Examination Topic: Chapter 7,8,9,10 Examination mark: 10 Passing Mark: 04 | Through the Quiz Test students will learn intellectual intelligence on the topics discussed. | 5) Basic Class Materials 6) Examination Kata |
| | 38. | Class Test 3 | Examination Topic: Chapter: 7,8,9,10 Examination mark: 10 Passing Mark: 04 | Through class tests students will learn to evaluate themselves on their own | 5) Basic Class Materials 6) Examination Kata |
| | 39. | Understand the system of electric traction. | 15.1 State the meaning of electric traction. 15.2 Describe the system of electric traction. 15.3 List the characteristics of an ideal traction system. 15.4 Describe the feeding and distribution system for tramways and trolleybuses. | After the Class, ✓ Students will be able to know about the system of electric traction. ✓ Students will be able to know about the characteristics of an ideal traction system. | Basic Class Materials & Projector, YouTube link: https://www.youtube.com/watch?v=tnHRpCs_m160 |
| | 40. | Practical 07 | PLOT THE VL - IL CHARACTERISTIC CURVE OF A SERIES GENERATOR | After the Class Students will be able learn about the followings materials Sketch the required diagram for the experiment. Collect the required instruments & materials. | Must be submitted within two classes |

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| | | | | <p>Connect all the meters and equipment as per diagram.</p> <p>Record the necessary readings from the meters.</p> <p>Plot the VL-IL curve from the data.</p> <p>Maintain the record of performed task.</p> | |
| 41. | Understand the system of electric traction. | <p>15.5 Explain the diesel electric drive, battery electric drive and electric drive of locomotives.</p> <p>15.6 Explain the working principle of tramways and trolleybuses.</p> <p>15.7 Explain the DC system used in traction.</p> <p>15.8 Explain the reasons for using DC series motor for traction purpose</p> <p>Starting slip ring induction motor. .</p> | <p>After the Class,</p> <p>✓ Students will be able to know about the working principle of tramways and trolley buses.</p> <p>✓ Students will be able to know about the DC system used in traction.</p> | Basic Class Materials & Projector, mini AC motor 12v | |
| 42. | Understand the concept of speed control of traction motors. | <p>16.1 Explain different methods of speed control of DC traction motors.</p> <p>16.2 Explain starting methods and speed control of DC series motors.</p> <p>16.3 Explain the starting method of the 3-phase induction motor used in traction.</p> <p>16.4 Explain the speed control system of the 3-phase induction motor used in traction.</p> <p>16.5 Explain different braking systems.</p> <p>16.6 Explain the systems of supplying power in electric traction.</p> | <p>After the Class,</p> <p>✓ Students will be able to know about the speed control of an induction motor.</p> <p>✓ They will be able to control the speed of an induction motor.</p> | <p>Basic Class Materials & Projector, mini AC motor 12v</p> <p>YouTube link: https://www.youtube.com/watch?v=tnHRpCs_m160</p> | |
| 43. | Review Class | Review Class of Lecture 11,12,13,14 (Regarding students problem) | Through the review class, students can solve their problem | Basic Class Materials | |

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| | 44. | Practical 08 | PLOT THE VL- IL CHARACTERISTIC CURVE OF A COMPOUND GENERATOR. | <p>After the Class</p> <p>Students will be able learn about the followings materials</p> <p>Sketch the required diagram for the experiment.</p> <p>Collect the required instruments & materials.</p> <p>Connect all the meters and equipment as per diagram.</p> <p>Record the necessary readings from the meters.</p> <p>Plot the VL-IL curve from the data.</p> <p>Maintain the record of performed tasks.</p> | Must be submitted within two classes |
| | 45. | Assignment -04 | Chapter: 11,12,13,14,15 | | Must be submitted within two classes |
| | 46. | Quiz Test 4 | Examination Topic: Chapter 11,12,13,14,15 Examination mark: 10 Passing Mark: 04 | Through the Quiz Test students will learn intellectual intelligence on the topics discussed. | 7) Basic Class Materials 8) Examination Kata |
| | 47. | Class Test 4 | Examination Topic: Chapter 11,12,13,14,15 Examination mark: 10 Passing Mark: 04 | Through class tests students will learn to evaluate themselves on their own | 7) Basic Class Materials 8) Examination Kata |
| | 48. | Presentation | Short presentation by individual students. | Be confident in practical life. | Laptop, projector |

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| | 49. | MODEL TEST | All Syllabus | After the Class, Students will be highly confident for Final exam | Basic Class Materials |
| | 50. | Final Exam Syllabus Review | | | |
| | 51. | Final Exam Syllabus Review | | | |
| | 52. | Final Exam Syllabus Review | | | |