

Exam.	Back		
Level	BE	Full Marks	40
Programme	BEL	Pass Marks	16
Year / Part	III / I	Time	1 ½ hrs.

Subject: - Electric Machines II (EE601)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) Explain load characteristics of synchronous generator. Why terminal voltage of a synchronous generator is greater than internal generated emf (E) in case of capacitive load? Explain with the help of armature reaction and phasor diagram. [8]
- b) A 3-phase, star connected synchronous generator is rated at 1.5 MVA, 11kV. The armature effective resistance and synchronous reactance are 1.2 Ω and 25 Ω respectively per phase. Calculate the percentage voltage regulation for a load of 1.4375 MVA at i) 0.8 p.f. lagging and ii) 0.8 p.f. leading. Also find out the p.f. at which regulation is zero. [6]
2. a) A synchronous motor can operate as both inductive and capacitive characteristics. Justify this statement with relevant diagrams. [7]
- b) A 25 MVA, 3-phase star connected 11 kV, 12 poles, 50 Hz salient pole synchronous motor has direct axis reactance of 48 ohm and quadrature axis reactance of 3.5 ohm per phase. The armature resistance being negligible. At rated load, unity power factor and rated voltage, Determine,
 - (i) Excitation Voltage
 - (ii) Maximum value of power angle and corresponding power [7]
3. a) Explain the operating principle of stepper motor and list their application. [6]
- b) Explain the operating principle and Speed-Torque Characteristics of Single Phase Capacitor start Capacitor run-Induction Motor with suitable diagram. [6]

Exam.	Regular		
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1. a) State the required conditions for the parallel operation of alternators. Also explain synchronizing process by three lamp method with neat sketch. [7]
- b) A star connected 50 kVA, 440V, 50 Hz alternator has effective armature resistance of 0.25Ω per phase, synchronous reactance is 3.2Ω per phase and the leakage reactance is 0.5Ω per phase. At rated load and unity power factor, Determine: [7]
 - (i) Internal emf
 - (ii) No-load emf
 - (iii) Percentage voltage regulation at full load
2. a) In what manner does a synchronous motor adjust itself to an increasing shaft load? [6]
- b) A 3.3 kV, 50 Hz star connected synchronous motor has a synchronous impedance of $(0.8 + j 55) \Omega$. It is synchronized to 3.3 kV main from which it is drawing 750 kW at an excitation emf of 4.27 kV (line). Determine the armature current, power factor and power angle. Also find the mechanical power developed. If the stay load loss is 30 kW, find the efficiency. [8]
3. a) A 230 V, 50Hz, 4pole, class A, Single phase induction motor has the following parameters $r_{1m} = 2.51 \Omega$, $r_2^1 = 7.81 \Omega$, $x_m = 150.88 \Omega$, $x_{1m} = 4.62 \Omega$, $x_2^1 = 4.62 \Omega$. Determine the main winding current and power factor when the motor is running at a slip of 0.05. [6]
- b) How does double revolving field theory, describe the operation of single phase induction motor? Explain with proper diagrams and expressions. [6]

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1. a) Define the pitch factor and distribution factor and their significance in synchronous machine. Derive the e.m.f equation of an alternator. [8]
- b) Three lamps can be used for synchronization of two alternators. Explain it with proper justification. [6]
2. a) Explain power angle characteristics of cylindrical rotor machine. [6]
- b) A four pole, single phase, 120 V, 50 Hz induction motor gave the following standstill impedances when tested at rated frequency. Main winding: $Z_n = (1.5+j4)$ ohms. Auxiliary winding: $Z_a = (3+j6)$ ohms. If an external capacitor of $1000\mu\text{F}$ is inserted in series with the auxiliary winding to obtain higher starting torque. Calculate the percentage increase in starting torque. [6]
3. a) State and explain the double field revolving theory of single phase induction motor with detailed diagram. [8]
- b) "synchronous motor is not self starting" Explain it with proper justification. [6]

Examination Control Division
2073 Shrawan

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	40
Programme	BEL	Pass Marks	16
Year / Part	III / I	Time	1 ½ hrs.

Subject: - Electric Machine II (EE601)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) What are the conditions to be fulfilled for operating two 3-phase alternators in parallel? Explain the process of synchronizing two alternators by three lamp method. [7]
- b) A 3-phase, star-connected 3-phase synchronous generator is rated as 1500 kVA, 11kV. The armature winding resistance is 0.8 ohm per phase and synchronous reactance is 4 ohms per phase. If the generator is supplying power to a three phase balanced load of $(80+j60)$ ohm per phase at rated terminal voltage, calculate emf generated and voltage regulation. Is the generator overloaded OR under-loaded? Calculate the percentage by which it is overloaded OR under-loaded. [7]
2. a) Explain the effect of varying excitation on armature current and power factor in a synchronous motor. Draw V curves and state their significance. [7]
- b) A 660 V, 3-phase, star-connected synchronous motor draws 50 kW at power factor of 0.8 lagging. Find the new current and power factor when the back e.m.f increases by 25%. The machine has synchronous reactance of 3Ω and effective resistance is negligible. [7]
3. a) Explain the double revolving field theory for operation of single phase induction motor. [6]
- b) Explain the construction and working principle of stepper motors. Also give some of its applications. [6]
