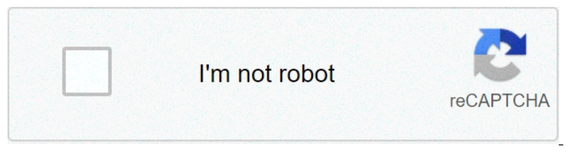

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Dc shunt motor example problems

Given data P = 4 No.of slots = 51 No.of conductors/slot = 20 Eg= 0.24 Kv = 240 V Φ = 10 mW= 10/1000 Web Find N &Eg at same N? Solution Total no. of conductors, Z = 51x20 = 1224 Wave winding, A=2 From EMF equation, N= Eg60A / ΦZP = (240x60x2)/(10/1000x1224x4) = 612.75 rpm Lap winding, A=P=4 Eg = PΦZN/60A = (4x10/1000x1224x612.75)/(60x4) = 0.125 kV 2. A 250 volt DC shunt motor has armature resistance of 0.25 ohm on load it takes an armature current of 50A and runs at 750rpm. If the flux of the motor is reduced by 10% without changing the load torque, find the new speed of the motor.Given dataV = 250Ra = 0.25Ia = 50N1 = 750Φ2 = 90%Φ1Find N2?SolutionEb1 = V-Ia1Ra = 250-(50x0.25) = 237.5VEb2 = V-Ia2RaLoad torque is constantTa1 = Ta2Φ1Ia1 = Φ2Ia2Ia2 = 55.55AEb2 = 250-55.55X0.25 = 236.12VN2 = 828 rpmPage 2DC MACHINES 1. Give advantages of three phase system over single phase system. Ø Output of three phase machine is greater than single phase machine of same size. Ø Three phase transmission system is more economical than single phase transmission system as less copper or aluminum is required. Ø Three phase motors are normally self starting as against single phase motors. 2. Define stalling current of DC motor. Armature current, Ia = V - Eb/Ra At starting; Eb = 0. Stalling current = V/Ra 3. List the essential parts of a DC generator. Yoke, Poles, Brushes, Bearings, Shaft, Commutator, Pole shoes, commutator poles and armature windings. 4. Why yoke is required in a DC machine? It gives a protective cover to the machine and is a mechanical support for poles. 5. Why is the core of the armature laminated? It helps in reducing eddy current losses. 6. Give the emf equation of a DC generator. Generated emf, E=PΦZN/60A Where, P- No. of poles, Φ – flux per pole, Z - No. of conductors, N – Speed of the armature and A - No. of parallel paths. 7. Give the type of armature windings used in DC machines. 1 Wave winding ii. Lap winding 8. Give the conditions to build up voltage in shunt generator. i. Residual magnetism should be there in the poles. ii. The field winding should be connected with armature in proper way. iii. The shunt field resistance should be less than the critical resistance under no load conditions. 9. List the main parts of stator of DC machine. i. Yoke ii. Field winding iii. Main poles iv. Commutator poles v. 10. What is the Commutator pitch of a 4 pole DC armature having 49 Commutator bars? Commutator pitch, yc = (No. of Commutator bars (+/-) 1)/No. of pairs of poles = 49(+/-) 1/2 = 24 or 25 11. State Faraday's law of Electromagnetic induction. Whenever there is a change in the magnetic flux linked with a circuit, an emf is induced in the circuit. The magnitude of the induced emf is proportional to the rate of change of flux linkages. 12. Give an application of a differentially compounded generator. It is mainly used in arc welding where larger voltage drop is desirable with increasing in current. 13. Why series motor cannot be started without any load? In series motor, Φ is directly proportional to Ia under no load conditions, the armature current is extremely low and flux is also less. By N is inversely proportional to Φ, it is clear that; low Φ will result in extremely high motor speed. Hence series motor should always be started with some load on shaft. 14. What is the significance of back emf? In motoring mode, armature induced emf is known as the back emf to stress the fact that it opposes armature emf. It plays the rule of a regulator. 15. Give the reason for high starting current in a DC motor. For large motors the armature resistance may be 0.01 pu or less. Thus in full voltage starting of a DC motor, the armature current can be several times (100 times of large motors) the rated value. 16. List the methods of speed control of DC shunt motor. i. Field control ii. Armature control iii. Armature resistance control iv. Ward-Leonard control v. 17. What are the different methods of excitation of generator? i. Separate excitation ii. Shunt excitation iii. Series excitation iv. Compound excitation 18. Define the term armature reaction? The interaction between the flux setup by the current carrying conductors with the main field flux is defined as armature reaction. 19. Define critical resistance of a DC shunt generator. It is defined as the resistance of the field circuit which will cause the shunt generator just to build up its emf at specified speed. 20. Mention the applications of DC series motor. i. Electric traction ii. Hoists iii. Cranes iv. Battery powered vehicles 21. What are the functions of interpoles and how are the interpole windings connected? Commutating winding is placed on interpoles to aid commutation process by inducing emf in commutating coils to cancel reactance emf. So interpoles are located the interpolar region along MNA of main poles in just above the brushes where the coils undergo commutation. 22. What is the importance of residual emf in self excited DC generator? The residual emf in self excited DC generator is used to develop emf in an armature. 23. A DC motor operates from a 240V supply; the armature resistance is 0.2 ohm. Determine the back emf when the armature current is 50A. Given Data: V = 240V, Ra = 0.2 ohm, Ia = 50A. Solution: Back emf, Eb=V-Ia x Ra = 240-50 x 0.2 = 230V. 24. An 8 pole, wave wounded armature has 600 conductors and is driven at 625 rpm. If the flux per pole is 20 mWb, determine the generated emf. Given Data: P = 8, Z = 600, N = 625 rpm, Φ =20 mWb. Wave winding, A = 2 Solution: Generated emf, E=PΦZN/60A = 8 x 20 x 10-3 x 600 x 625/60 x 2 = 500V. Page 3 TRANSFORMERIntroductionA transformer is a device that changes ac electric power at one voltage level to ac electric power at another voltage level through the action of a magnetic field.There are two or more stationary electric circuits that are coupled magnetically.It involves interchange of electric energy between two or more electric systems.Transformers provide much needed capability of changing the voltage and current levels easily.They are used to step-up generator voltage to an appropriate voltage level for power transfer.Stepping down the transmission voltage at various levels for distribution and power utilization.1. Transformer ClassificationIn terms of number of windingsConventional transformer: two windingsAutotransformer: one windingOthers: more than two windingsIn terms of number of phasesSingle-phase transformerThree-phase transformerDepending on the voltage level at which the winding is operatedStep-up transformer: primary winding is a low voltage (LV) windingStep-down transformer : primary winding is a high voltage (HV) winding2. Primary and Secondary WindingsA two-winding transformer is shown below. It consists of two windings interlinked by a mutual magnetic field.Primary winding –energized by connecting it to an input source.Secondary winding –winding to which an electrical load is connected and from which outputenergy is drawn.3. Functions of Transformer Parts4. Principle of Operation When current in the primary coil changes being alternating in nature, a changing magnetic field is producedThis changing magnetic field gets associated with the secondary through the soft iron coreHence magnetic flux linked with the secondary coil changes.Which induces e.m.f. in the secondary.5. Ideal Transformer An ideal transformer is a transformer which has no loses, i.e. it's winding has no ohmic resistance, no magnetic leakage, and therefore no I2 R and core loses.However, it is impossible to realize such a transformer in practice.Yet, the approximate characteristic of ideal transformer will be used in characterized the practical transformer.For ideal transformer E1=V1 and E2= V2 Problem Solving on D.C Machines Electrical Engineering (EE) Notes | EduRev, ppt, Previous Year Questions with Solutions, Problem Solving on D.C Machines Electrical Engineering (EE) Notes | EduRev, Extra Questions, Viva Questions, study material, Objective type Questions, Important questions, MCQs, mock tests for examination, Semester Notes, Summary, Problem Solving on D.C Machines Electrical Engineering (EE) Notes | EduRev, past year papers, Sample Paper, Exam, practice quizzes, Free, shortcuts and tricks, video lectures, pdf ; Problem 10.6A dc shunt motor is supplied by a 12 V car battery. The motor shunt coil resistance is 15 and the armature resistance is 0.03 ohms. In open circuit conditions the motor speed is 700 rpm, and its input current is 5 A. Calculate the motor speed at a load of 0.5 hp. 1. A shunt generator delivers 450 A at 230 V and the resistance of the shunt field and armature are 50 Ω and 0.03 Ω respectively. Calculate the generated e.m.f? Solution: The Generator Circuit is as shown in the figure,2. A four pole generator having wave-wound armature winding has 51 slots, each slot containing 20 conductors. What will be the voltage generated in the machine when driven at 1500 rpm assuming the flux per pole to be 7.0 mWb ? Solution: For a simplex wave wound generator,