Bharatiya Vidya Bhavan's

# SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)
Munshi Nagar, Andheri (W) Mumbai – 400058

**End Sem - May 2019 Examinations**

**Program: B. Tech Electrical Engineering** | **Duration: 3 Hr.**

**Course Code: HS-BTE-801** | **Maximum Points: 100**

**Course Name: Engineering Economics** | **Semester: VIII**

**Notes:**

- Question **no.1** is compulsory
- Attempt any **four** out of the remaining
- Solve up to **three/four places** of decimal to get **whole number**
- Draw neat **cash flow** diagrams.

| Q.No. | Questions | Points | CO | BL | PI |
|---|---|---|---|---|---|
| Q1 | i) Draw and explain neatly break-even analysis chart and its components.<br>ii) Define value analysis (VA)/ value engineering (VE). Discuss the symptoms favouring the applications of VA/VE.<br>iii) What are the ways by which the economic efficiency can be improved? | **07**<br>**07**<br>**06** | 1<br>2<br>1 | 2,4 | 1.3.1 |
| Q2 a) | Jyoti Lakshimi has arranged to buy some home recording equipment. She estimates that it will have a five year useful life and no salvage value at the end of equipment life. The dealer, who is a friend has offered Jyoti Lakshimi two alternative ways to pay for the equipment.<br>(a) Pay Rs. 60,000 immediately and Rs. 15,000 at the end of one year.<br>(b) Pay nothing until the end of fourth year when a single payment of Rs. 90,000 must be made.<br>If Jyoti Lakshimi believes 12% is a suitable interest rate, which alternative is the best for her? | **12** | 2 | 3 | 2.4.1 |
| b) | Investment proposals A and B have the net cash flows as follows:<br>*Proposal* / *End of years*: 0, 1, 2, 3, 4<br>A (Rs.): –10,000, 3,000, 3,000, 7,000, 6,000<br>B (Rs.): –10,000, 6,000, 6,000, 3,000, 3,000<br>Compare the **present worth** of A with that of B at $i$ = 18%. Which proposal should be selected? | **08** | 2 | 3 | 2.4.1 |

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**End Sem - May 2019 Examinations**

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|---|---|---|---|---|---|
| Q3a) | A machine was purchased two years ago for Rs. 10,000. Its annual maintenance cost is Rs. 750. Its life is six years and its salvage value at the end of its life is Rs. 1,000. Now, a company is offering a new machine at a cost of Rs. 10,000. Its life is four years and its salvage value at the end of its life is Rs. 4,000. The annual maintenance cost of the new machine is Rs. 500. The company which is supplying the new machine is willing to take the old machine for Rs. 8,000 if it is replaced by the new machine. Assume an interest rate of 12%, compounded annually.<br>(a) Find the comparative use value of the old machine.<br>(b) Is it advisable to **replace** the old machine? | **12** | 3 | 3 | 2.4.1 |
| b) | A company is trying to diversify its business in a new product line. The life of the project is 10 years with no salvage value at the end of its life. The initial outlay of the project is Rs. 20,00,000. The annual net profit is Rs. 3,50,000. Find the **rate of return** for the new business | **08** | 3 | 3 | 2.4.1 |
| Q4a) | A company invests in one of the two mutually exclusive alternatives. The life of both alternatives is estimated to be 5 years with the following investments, annual returns and salvage values.<br><br>*Alternative*<br>A / B<br>Investment (Rs.) – 1,50,000 / – 1,75,000<br>Annual equal return (Rs.) + 60,000 / + 70,000<br>Salvage value (Rs.) + 15,000 / + 35,000<br><br>Determine the best alternative based on the **annual equivalent** method by assuming $i = 25\%$. | **12** | 2 | 3 | 2.4.1 |
| b) | A company has purchased an equipment whose first cost is Rs. 1,00,000 with an estimated life of eight years. The estimated salvage value of the equipment at the end of its lifetime is Rs. 20,000. Demonstrate the calculations of the declining balance method of **depreciation** by assuming 0.2 for $K$. | **08** | 3 | 3 | 2.4.1 |

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**End Sem - May 2019 Examinations**

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|---|---|---|---|---|---|
| Q5a) | If a product is to be manufactured within the company, the particulars are:<br>$r$ = 12,000 units/year<br>$k$ = 24,000 units/year<br>$Co$ = Rs. 175/set up<br>$Cc$ = Rs. 15/unit/year<br>Find the EOQ and cycle time | **10** | 3 | 3 | 2.4.1 |
| B) | Solve the following **Linear Programming problem** using the graphical method:<br>Minimize $Z = 2X1 + 3X2$<br>subject to<br>$X1 + X2 \geq 6$<br>$7X1 + X2 \geq 14$<br>$X1, X2 \geq 0$ | **10** | 3 | 3 | 5.1.2 |
| Q6a) | M/S Krishna Castings Ltd. is planning to replace its annealing furnace. It has received tenders from three different original manufacturers of annealing furnace. The details are as follows. | **12** | 2 | 3 | 2.4.1 |

| | *Manufacturer* | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Intial cost (Rs.) | 80,00,000 | 70,00,000 | 90,00,000 |
| Life (years) | 12 | 12 | 12 |
| Annual operation and maintenance cost (Rs.) | 8,00,000 | 9,00,000 | 8,50,000 |
| Salvage value after 12 years | 5,00,000 | 4,00,000 | 7,00,000 |

Which is the best alternative based on **future worth method** at $i$ = 20%?

| | | | | | |
|---|---|---|---|---|---|
| b) | Distinguish between declining balance method of depreciation and double declining balance method of depreciation. | **08** | 3 | 2 | 1.3.1 |
| Q7a) | The annual demand for a component is 30,000 units. The carrying cost is Rs. 2.00/unit/year, the ordering cost is Rs. 100.00/order, and the shortage cost is Rs. 12.00/unit/year. Find the optimal values of the following:<br>(a) Ordering quantity<br>(b) Maximum inventory<br>(c) Maximum shortage quantity<br>(d) Cycle time<br>(e) Inventory period ($t1$)<br>(f) Shortage period ($t2$) | **10** | 2 | 3 | 2.4.1 |
| b) | What are the approaches available for make or buy decisions? Explain any one of them with a suitable example. | **10** | 2 | 2 | 1.3.1 |

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# SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)

Munshi Nagar, Andheri (W) Mumbai – 400058

**End Semester - May 2019 Examinations**

**Program: B. Tech. (Electrical)** **Duration: 3 hrs.**

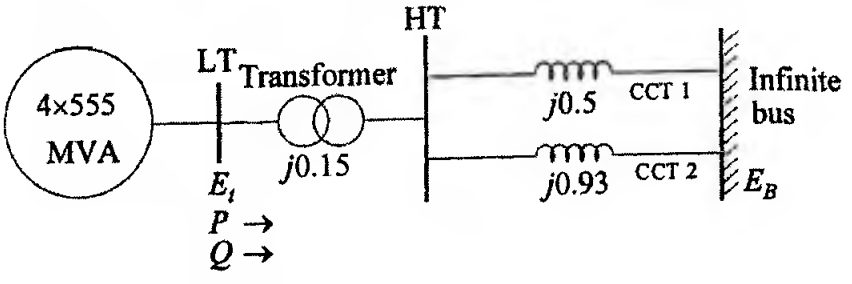
**Course Code: PE-BTE801** **Maximum Points: 100**

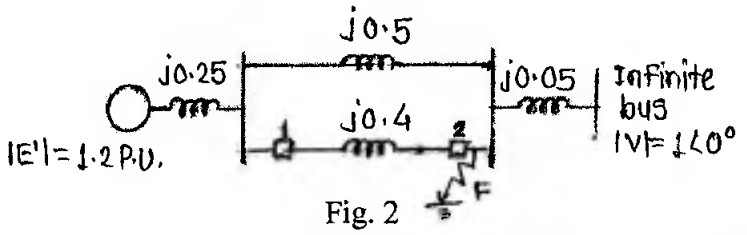
**Course Name: Power system dynamics and control** **Semester: VIII**

**Notes:**

1. Question number 1 compulsory.
2. Attempt any **four** questions out of remaining **six.**
3. Draw neat diagrams.
4. Assume suitable data if necessary.

| Q. No. | Questions | Pts. | CO | BL | PI |
|---|---|---|---|---|---|
| 1. | A 20 MVA, 50 Hz generator delivers 18 MW over a double circuit line to an infinite bus. The generator has kinetic energy of 2.52 MJ/MVA at rated speed. The generator transient reactance is $X'_d = 0.35$ pu. Each transmission circuit has R = 0 and a reactance of 0.2 pu on a 20 MVA base. $\|E'\| = 1.1$ pu and infinite bus voltage V $= 1.0\angle 0^0$. A three-phase short circuit occurs at the midpoint of one of the transmission lines. Plot swing curves with fault cleared by simultaneous opening of breakers at both ends of the line at 2.5 cycles using **Runge-Kutta (Order-2)** method. | 20 | 2 | L4 | 2.4.2 |
| 2. (a) | A generator operating at 50 Hz delivers 1 pu power to an infinite bus through a transmission circuit in which resistance is ignored. A fault takes place reducing the maximum power transferable to 0.5 pu whereas before the fault, this power was 2.0 pu and after the clearance of the fault, it is 1.5 pu. By use of equal are criterion, determine the critical clearing angle. (Consider initial mechanical input power 1.0 pu) | 10 | 2 | L3 | 2.2.3 |
| (b) | Explain in detail small signal stability of dynamic system by using following points<br>a) State space representation<br>b) Concept of state<br>c) Equilibrium points<br>d) Stability of linear and nonlinear system | 10 | 1 | L2 | 2.1.2 |

| | | | | | |
|---|---|---|---|---|---|
| 3. | Derive expression for small signal stability of a single machine infinite bus system with the help of following points<br>1. Classical model representation<br>2. State space representation<br>3. Block diagram representation<br>4. Expression of damping ratio ($\xi$) and natural frequency ($\omega_n$) | 20 | 1 | L2 | 2.1.2 |
| 4. | With the help of neat diagram explain in detail<br>1. Classical model representation of synchronous machine<br>2. Higher order model representation of synchronous machine. | 20 | 1 | L2 | 2.1.2 |
| 5. | Fig.1 shows the system representation applicable to thermal generating station consisting of four 555 MVA, 24 KV, 60 Hz units<br>  <br><br>Fig. 1<br>The network reactances shown in figure are in per unit on 2220 MVA, 24 KV base. Resistances are assumed to be negligible.<br>Type of fault occur: **Loss of circuit 1 (CCT 1)**<br>The post fault system condition in per unit on the 2220 MVA,<br>24 KV base is as follows:<br>P = 0.9 Q = 0.3 (overexcited) $E_t = 1.0\angle 36^0$ $E_B = 0.995\angle 0^0$<br>The generators are modeled as a single equivalent generator represented by the classical model with the following parameters expressed in per unit on 2220 MVA, 24 KV base:<br>$X'_d = 0.3$ $H = 3.5\ MW.s/MVA$<br>Write the linearized state equation of the system. Determine the eigen values, Damped frequency of oscillation in Hz, damping ratio and undamped natural frequency for each of the following values of damping coefficient (in pu torque/ pu speed) :<br>$(i)\ K_D = 0$ $(ii)\ K_D = -10.0$ $(iii)\ K_D = 10.0$ | 20 | 2 | L4 | 2.4.2 |

| | | | | | |
|---|---|---|---|---|---|
| 6.(a) | Write short note on<br>1. P-V Curve<br>2. Q-V Curve<br>3. P-Q Curve | 10 | 1 | L2 | 2.2.3 |
| (b) | Give the system of Fig. 2 as shown. where a three-phase fault is applied at the point P as shown<br>  <br><br>Fig. 2<br>Find the critical clearing angle for clearing the fault with simultaneous opening of the breakers 1 and 2. The reactance values of various components are indicated on the diagram. The generator is delivering 1.0 pu power at the instant preceding the fault. | 10 | 2 | L3 | 2.2.3 |
| 7.(a) | Which are methods of transient stability enhancement? Explain in detail Steam turbine fast valving. | 10 | 1 | L2 | 2.1.2 |
| (b) | Write short note on<br>1. V-Q Sensitivity analysis<br>2. Q-V model analysis | 10 | 1 | L2 | 2.1.2 |

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Munshi Nagar, Andheri (W) Mumbai – 400058

**END SEMESTER - MAY 2019 Examination**

**Program: B.Tech (ELECTRICAL)** | **Duration: 03 Hour**

**Course Code: PE-BTE 802** | **Maximum Points: 100**

**Course Name: Smart Grid** | **Semester: VIII**

**Notes: Attempt any FIVE questions out of SEVEN.**

**Draw neat diagrams wherever necessary.**

| Q.No. | Questions | Points | CO | BL | PI |
|---|---|---|---|---|---|
| Q 1. (a) | What is the concept of Smart Grid? Hence explain any two case studies in detail on smart grid initiative in India. | 02+04+04 | 01 | L-1 | 1.4.1 |
| Q 1. (b) | How does advanced metering infrastructure (AMI) play an important role in smart grid implementation? Explain this in details with AMI building blocks. | 02+08 | 01 | L-2 | 1.4.1 |
| Q 2. (a) | Explain the present trends in analysis, design and evaluation of PHEV & smart sensors in the future smart grid environment. | 06+04 | 02 | L-2 | 1.4.1 |
| Q 2. (b) | What is outage management system (OMS)? Draw the OMS architecture and explain the role of different systems used in it to improve reliability & security of smart grid. | 02+02+06 | 02 | L-1 | 1.4.1 |
| Q 3. (a) | How does Intelligent Electronic Devices work in smart grid? Explain IEDs application in monitoring and protection of smart grid with it's functional overview block diagram. | 04+06 | 02 | L-2 | 1.4.1 |
| Q 3. (b) | How does a Phasor Measurement Unit (PMU) work? Hence describe wide area measurement system based on new data acquisition technology used for smart grid network. | 05+05 | 02 | L-2 | 1.4.1 |
| Q 4. (a) | What is micro grid? Hence describe the issues of interconnection, protection and control pertaining to microgrid. | 02+08 | 03 | L-1 | 1.4.1 |
| Q 4. (b) | Write short notes on organic solar cells, variable speed wind generators and micro turbines (with diagram) used in micro grid. | 03+04+03 | 03 | L-1 | 1.4.1 |
| Q 5. (a) | What is power quality and EMC in smart grid? What is power quality conditioner? Hence explain any two types of conditioner in detail | 01+01+08 | 03 | L-1 | 1.4.1 |

| | | | | | |
|---|---|---|---|---|---|
| | (with diagram) to maintain power quality in smart grid. | | | | |
| Q 5. (b) | What is power quality audit? Hence explain the different steps to perform PQ audit. Also describe the web based power quality monitoring system used in smart grid. | 01+04+05 | 03 | L-1 | 1.4.1 |
| Q 6. (a) | What type of communication and networking technologies are used to implement HAN, NAN and WAN in smart grid? Also clearly differentiate between HAN, NAN and WAN. | 08+02 | 04 | L-1 | 1.4 |
| Q 6. (b) | Explain the features of Bluetooth, Zigbee, GPS, Wi-Fi and Wi-max based communication technologies used for smart grid implementation with clear distinction. | 02 x 05=10 | 04 | L-2 | 1.4.1 |
| Q 7. (a) | What is cloud computing? Explain it's importance in smart grid environment. What are various cyber security issues pertaining to smart grid and their possible solutions? | 02+02+06 | 04 | L-1 | 1.4.1 |
| Q 7. (b) | Explain broadband over power line (BPL) communication technique and different IP based protocols used for smart grid. | 04+06 | 04 | L-2 | 1.4.1 |

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**End Semester Examination - May 2019 Examinations**

Program: Electrical Engineering

Course Code: OE-BTE801

Course Name: **Robotics**

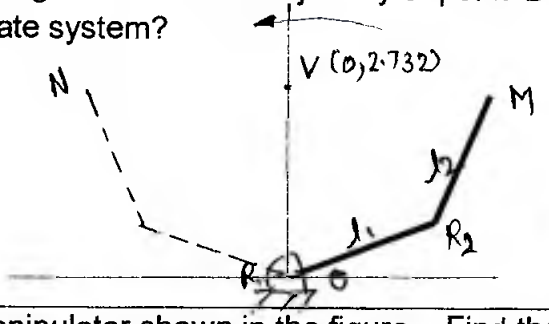
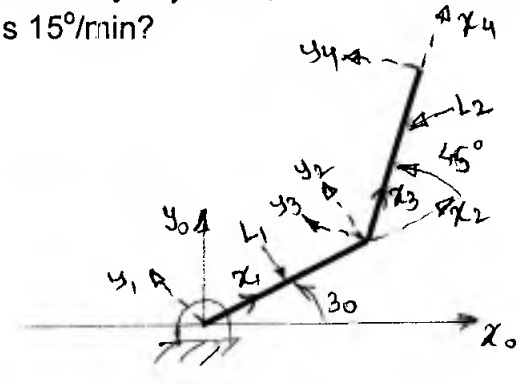
Duration: 03 hour

Maximum Points: 100 marks

Semester: **VIII**

Notes: 1.Questions number 01 is compulsory.
2. Solve any four main questions out of remaining six main questions.
3. Draw neat schematic diagrams wherever is necessary, highlight important points.
4. Assume suitable data if necessary and mention it.

| Q.No. | Questions | Mark | CO | BL | PI |
|---|---|---|---|---|---|
| Q1 A | Discuss about Cartesian robot with following points: i) Structure, capability & its limitation ii) Neat schematic sketch showing its workspace volume? | 10 | 2 | L3 | 1.2.4 |
| Q1 B | Determine control resolution of a polar robot with an radius of 24 inches and an angular rotation range of 270°, If the joint motor is receiving 8 bit DACS for position and feedback control?<br>Write short note on any one type of optical type encoder along with necessary sketch? | 10 | 3 | L1 | 2.1.3 |
| Q2 A | Write down systematic procedure, parameters and equations for selecting DC Servomotor for an particular intermittent operation with the help of necessary schematic sketch? | 10 | 1 | L3 | 3.1.2 |
| Q2 B | Write short note on position sensor potentiometer with necessary physical setup, circuit diagram, different material advantages in accuracy, error involved in measurements? | 10 | 2 | L2 | 3.2.2 |
| Q3 | In Electric motor manufacturing industry, A planar 2-R manipulators is installed to move an armature parts from point 'M' (2.732, 2.732) to point 'N'(-2.732, 2.732) though a via points 'V'(0, 2.732) in 2 second only. Initial, final position of links and fixed mechanism parameter data provided in fig. no. 1. Also state number of boundary conditions if mechanism is kinematically consistent, continuous motion through via points and motion of mechanism is coordinated?<br>Find the following;<br>1) Generalized equation for joint space angle's to define motion<br>2) Calculate Cartesian space co-ordinates of end effector point 'B' at regular time interval of 0.33 second and prepare the total table? | 20 | 3 | L3 | 5.2.1 |

| | | | | | |
|---|---|---|---|---|---|
| | 3) Plot graph of joint space angle Vs time and trajectory of point 'B' in Cartesian space co-ordinate system?<br>  <br><br>Fig. no. 1. | | | | |
| Q4 A | For the given 2 link (2-R) manipulator shown in the figure. Find the following;<br>a) Calculate velocity of end effector point as a function of angular velocity of joint<br>b) Evaluate resolved velocity component of end effector point on 'frame 4'?<br>c) Evaluate jacobian of transformation for velocity component & calculate velocity components (for give instant as shown in figure) of point 'EE' if angular velocity at joint $R_1$ is 25°/min and angular velocity at joint $R_2$ is 15°/min?<br>$L_1 = 2m$<br>$L_2 = 2m$<br>$\theta_1 = 30°$<br>$\theta_2 = 45°$<br>  <br><br>Fig. no. 2. | 10 | 4 | L3 | 2.1.4 |
| Q4 B | Write short note on Piezoelectric sensor with necessary circuit diagram and their specific applications?<br>With help of well labelled schematic sketch of "Organization of a computer based robotic manipulator" explain its components brief? | 10 | 2 | L2 | 1.3.1 |
| Q5 A | Consider the Microbot series robotic arm (Fig. no. 3.). Establish joint coordinate systems for the given robot configuration.<br>a) A table of joint parameters.<br>b) Complete direct kinematic solution for given robot.<br>c) Set of link co-ordinate system<br>d) Determine position and orientation of the end effector of robot if joint space parameters are represented as, [$90^0$ $0^0$ $-90^0$ $0^0$ $90^0$] | 20 | 4 | L4 | 3.4.2 |

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**End Semester Examination - May 2019 Examinations**

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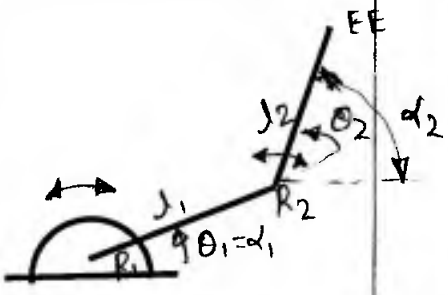
|---|---|---|---|---|---|
| Q6 A | Find the inverse kinematic solution for the spherical robotic manipulator transform SPH (Φ,ψ,r). Rotation about 'Z' axis and 'X' axis represented by angle Φ and ψ respectively. | 10 | 2 | L3 | 2.2.3 |
| Q6 B | To improve the following characteristics in stepper motor; a) Higher torque generation capability b) Precise position and speed control, Suggest which type of wave scheme can be applied to stepper motor to fulfill the requirement's?<br>Prepare table of switching sequence for clockwise rotation of motor shaft?<br>Draw necessary detailed stepwise sketch and explain that wave scheme? | 10 | 3 | L2 | 2.4.2 |
| Q7 A | A Motor supplier wants to assemble one thousand components (Part A with Part B) (in Fig. No. 4) in a shift using robotic arm manipulator. One its mating objects have spherical projections over the mate surface. Estimate the position and orientation of end effector and of an object just before gripping action (for lift) and just before final assembly position (for release). | 12 | 4 | L3 | 1.2.3 |
| Q7 B | For the given planar 2R manipulator, evaluate the following;<br>1) Joint space parameters as a function of mechanism parameters<br>2) How many solutions exist for given position of the end effector<br>3) To have infinite number of solutions, suggest list of mechanism parameter or joint parameters conditions required.<br>4) Suggest that particular condition of end effector for which no solution and one solution exist<br><br>Fig. No. 5. | 08 | 3 | L4 | 3.3.2 |



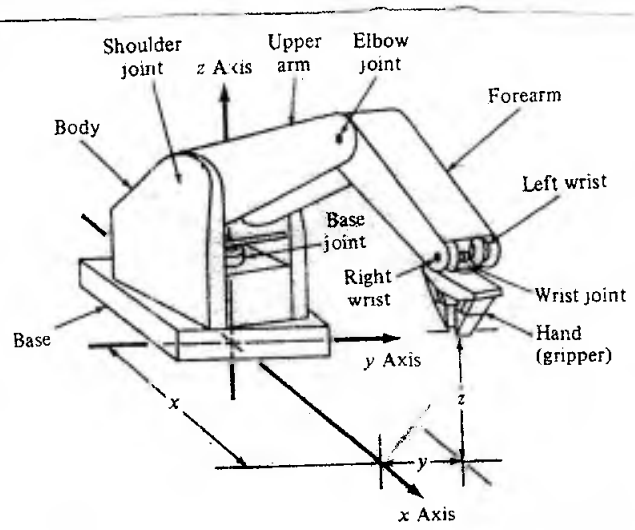



Fig. No. 3

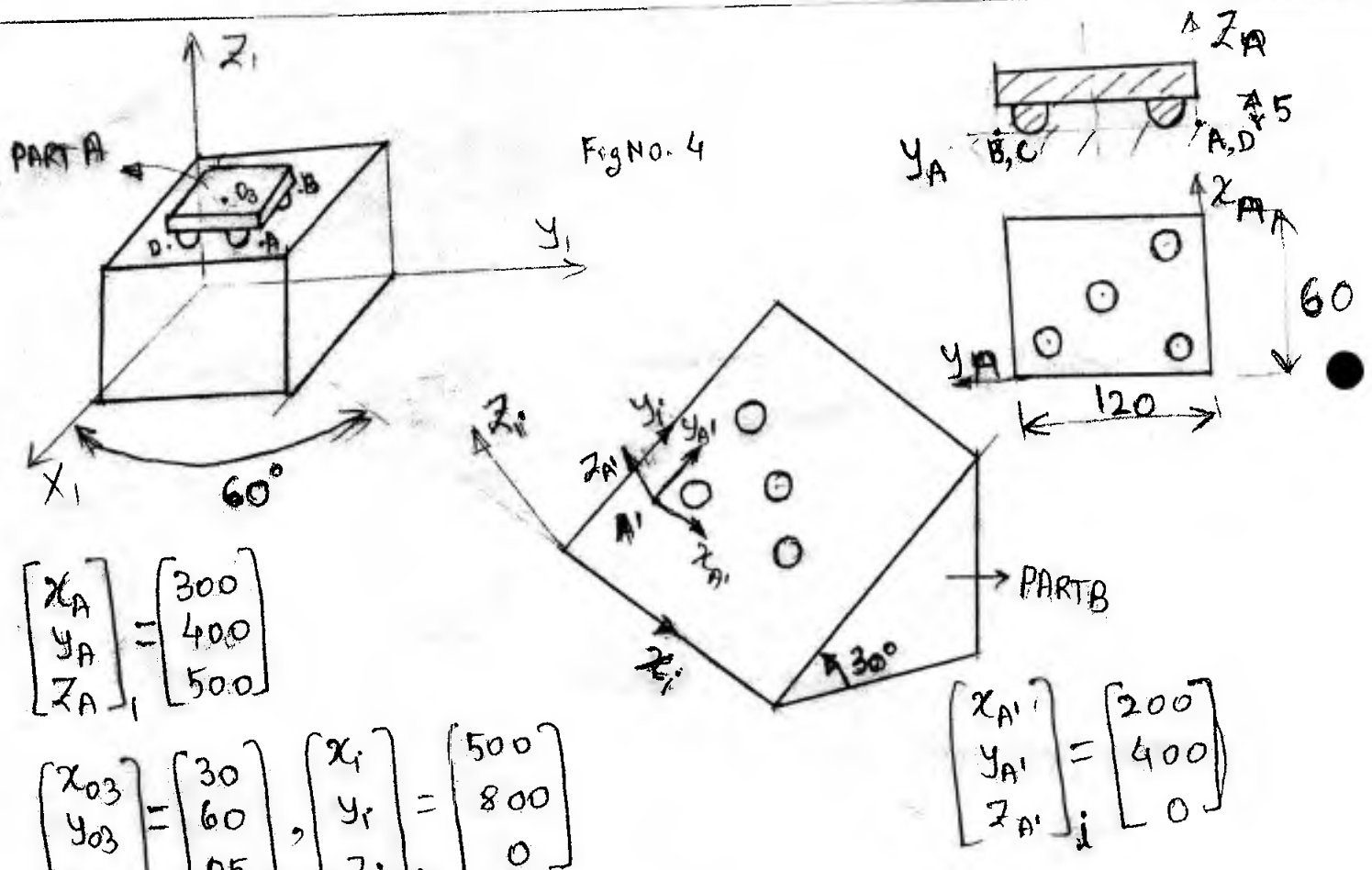



Fig No. 4

$$\begin{bmatrix} x_A \\ y_A \\ z_A \end{bmatrix}_1 = \begin{bmatrix} 300 \\ 400 \\ 500 \end{bmatrix}$$

$$\begin{bmatrix} x_{03} \\ y_{03} \\ z_{03} \end{bmatrix}_A = \begin{bmatrix} 30 \\ 60 \\ 05 \end{bmatrix}, \quad \begin{bmatrix} x_i \\ y_i \\ z_i \end{bmatrix}_1 = \begin{bmatrix} 500 \\ 800 \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} x_{A'} \\ y_{A'} \\ z_{A'} \end{bmatrix}_i = \begin{bmatrix} 200 \\ 400 \\ 0 \end{bmatrix}$$

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Munshi Nagar, Andheri (West), Mumbai – 400058

**ENDSEM- MAY 2019**

**Program: Electrical Engg**

**Duration: 3 hrs.**

**Maximum Marks: 100**

**Date: May 2019**

**Course code: OE BTE-802**

**Semester: VIII**

**Name of the Course: POWER PLANT ENGINEERING**

- **INSTRUCTIONS:**
- Answers to all sub questions should be grouped together
- Brief answers expected
- Solve any 5 questions

| Q. no | QUESTIONS | POINTS | CO | BL | PI |
|---|---|---|---|---|---|
| 1. A) | **With the help of Brayton cycle write note on Gas power plant.** | **8** | **1** | **2** | **1.2.1** |
| B) | **Write short note on 'Fast- breeder reactor' nuclear power plant using following points. Fuel, moderator, coolant, schematic and control rods** | **12** | **1** | **2** | **1.2.1** |
| | | | | | |
| 2. A) | **With the help of schematic diagram explain Integrated Gasification Combined cycle gas power plant.** | **12** | **1** | **2** | **1.2.1** |
| B) | **Why reheating of steam is done in Thermal power plant?** | **8** | **1** | **2** | **1.2.1** |
| | | | | | |
| 3. A) | **With the help of Rankine cycle T-S diagram explain how Thermal Power Plant works?** | **12** | **1** | **2** | **1.2.1** |
| B) | **Compare solar and wind turbine power plant on environment issues and social issues.** | **8** | **1** | **2** | **1.2.1** |

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**ENDSEM- MAY 2019**

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|---|---|---|---|---|---|
| 4. A) | Which operational aspects are need to implemented in Nuclear power plant to keep explosives at "ALARA" | 8 | 1 | 2 | 1.2.1 |
| B) | With the help of schematic diagram and T-S diagram, disadvantages and advantages write short note on Mercury-Steam Binary Vapor Cycle | 12 | 1 | 2 | 1.2.1 |
| | | | | | |
| 5. A) | What are LLW, ILW and HLW related to nuclear power plant radioactivity | 8 | 1 | 2 | 1.2.1 |
| B) | Explain the methods used to improve thermal efficiency of simple Gas turbine power plant. | 12 | 1 | 2 | 2.1.2 |
| | | | | | |
| 6. A) | Write short note on Hydro power plant using following points Types of Hydro Power Plant, site selection, components/equipments used in plant, plant effect on environment | 12 | 1 | 2 | 2.1.2 |
| B) | What emergency measures are taken in case of any abnormal conditions in Nuclear Power Plant? | 8 | 1 | 2 | 1.2.1 |
| | | | | | |
| 7. A) | Write short note on Fluidized bed combustion. | 12 | 1 | 2 | 1.2.1 |
| B) | The maximum demand of a power plant is 80MW. The capacity factor is 0.5 and the utilization factor is 0.8. Find Load factor, Plant capacity, reserve capacity and annual energy production | 8 | 1 | 2 | 2.1.2 |

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**End Semester - May 2019 Examinations**

**Program: B. Tech. (Electrical)** **Duration: 3 hrs.**

**Course Code: PE-BTE803** **Maximum Points: 100**

**Course Name: HVDC Transmission System** **Semester: VIII**

**Notes:**

1. Question number 1 compulsory.
2. Attempt any **four** questions out of remaining **six**.
3. Draw neat diagrams.
4. Assume suitable data if necessary.

| Q. No. | Questions | Pts. | CO | BL | PI |
|---|---|---|---|---|---|
| 1. | Explain in detail different types of fault occurs in HVDC transmission line. With the help of neat diagram explain in detail different protection schemes and components used in HVDC transmission system. | 20 | 2 | L2 | 2.1.2 |
| 2. (a) | With the help of following parameters determine the value of DC reactor used in HVDC transmission system $V_d = 200\,KV, f = 60\,Hz$, $I_d = 1.8\,KA$, $I_{s2} = 10KA$, $\gamma_n = 10^0$ $\gamma_m = 5^0$ | 10 | 3 | L3 | 2.2.3 |
| (b) | For three phases, 6-pulse Graetz's circuit derives expression for $V_{dc}$ and $I_{dc}$ considering overlapping angle more than $60^0$. | 10 | 2 | L3 | 2.2.3 |
| 3. | Describe the two basic firing angle control schemes adopted for HVDC system with neat sketches. Also discuss the merits and demerits of each scheme. | 20 | 2 | L2 | 2.1.2 |
| 4.(a) | In a monopolar HVDC link which is energized with 3-phase, 50Hz, 400 KV source, the commutation reactance is 10Ω and the rectifier (6-pulse bridge converter) end DC voltage is 500KV. For delay angle $20^0$.<br>a) Find the DC current in the link<br>b) Find commutation angle μ.<br>c) If AC voltage reduced to 200KV. Find the commutation angle μ. Assume the DC current is constant. | 10 | 3 | L3 | 2.2.3 |
| (b) | Explain with neat sketch different types of reactive power sources used in HVDC transmission line. | 10 | 1 | L2 | 2.1.2 |

| | | | | | |
|---|---|---|---|---|---|
| 5.(a) | With the help of neat block diagram and V-I characteristics explain in detail constant current (CC) and constant extinction angle (CEA) control in HVDC transmission line. | 10 | 2 | L2 | 2.1.2 |
| (b) | Explain in detail different types of filters used in HVDC transmission line. | 10 | 1 | L2 | 2.1.2 |
| 6.(a) | With the help of neat diagram and V-I characteristics compare operation of parallel and series MTDC link. | 10 | 2 | L2 | 2.1.2 |
| (b) | Explain in detail voltage stability in AC/DC system. | 10 | 1 | L3 | 2.1.2 |
| 7.(a) | Explain in detail potential application of MTDC system? Which are the types of MTDC system? | 10 | 2 | L2 | 2.1.2 |
| (b) | Explain in detail power modulation for synchronous and asynchronous HVDC link. | 10 | 1 | L2 | 2.1.2 |

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# SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)
Munshi Nagar, Andheri (W) Mumbai – 400058

**End Semester - May2019 Examinations**

**Program: Electrical Engineering.** | **Duration: 03 Hr.**

**Course Code:PE-BTE 804** | **Maximum Points:100**

**Course Name: POWER QUALITY & FACTS** | **Semester: VIII**

**Note:** Answer any five questions out of seven questions. (Qs.1 to Qs.7).
Draw neat circuit diagrams wherever necessary to support your answer.
Assume suitable data if necessary.

| Qs.No. | Questions | Points | CO | BL | PI |
|---|---|---|---|---|---|
| Qs.1 | a. P-δ curve of a two machine system can be improved using mid-point passive compensation. Justify the statement analytically. Support your answer with relevant phasor and circuit diagrams & characteristics. | 10 | 01 | 05 | 2.1.3 |
| | b. State the effects of following in attaining flexibility in AC power transmission:<br>1) Virtual $Z_0$ compensation<br>2) Compensation by section | 10 | 01 | 03 | 2.1.3 |
| Qs.2 | a. Name the three modes of operation of Thyristor Controlled Series Capacitor (TCSC) compensator & explain, how it will help to improve the stability of power system. Support your answer with relevant circuit diagrams & characteristics. | 10 | 02 | 02 | 2.2.2 |
| | b. Compare the V-I characteristics of the following shunt compensators:<br>i. Thyristor switched Capacitor-Thyristor Switched Reactor (TSC-TSR)<br>ii. Fixed Capacitor-Thyristor Controlled reactor (FC-TCR) | 10 | 02 | 02 | 2.2.4 |
| Qs.3 | a. Name and explain any two Pulse-Width Modulation techniques used for VSCs | 10 | 02 | 03 | 2.3.1 |
| | b. Draw and illustrate the Circuit topology, Switching states and output voltage of three phase Voltage Source Inverter. | 10 | 02 | 02 | 2.3.1 |

| | | | | | |
|---|---|---|---|---|---|
| Qs.4 | a. Illustrate the control strategy used in UPFC to attain Line length compensation, with the support of basic schematic diagram & phasors. | 10 | 02 | 03 | 2.3.2 |
| | b. What is Fault Current Limiter (FCL) & State the main purpose of the installation of FCL into the distribution system and how is it achieved using a super conducting FCL. | 10 | 02 | 03 | 2.3.1 |
| Qs.5 | a. Eplain the following application of FACTS deviees<br>1. Voltage regulation of transmission line mid-point voltage using STATCOM.<br>2. Power flow control using SSSC | 10 | 02 | 02 | 2.3.1 |
| | b. State the classification of power quality issues in power distribution system | 10 | 03 | 01 | 2.2.1 |
| Qs.6 | a. What is DSTATCOM and how does it support for voltage regulation? Support your answer with relevant phasor and circuit diagrams. | 10 | 04 | 03 | 2.3.1 |
| | b. How is Harmonics mitigation attained in Distribution Systems using Shunt Active Filters? Support your answer with relevant diagrams. | 10 | 04 | 03 | 2.3.1 |
| Qs.7 | How does the following devices support for mitigation of power quality issues: | | | | |
| | a. Dynamic Voltage Restorer (DVR) | 08 | 04 | 04 | 2.3.1 |
| | b. Series Active Filter (SAF) | 06 | 04 | 04 | 2.3.1 |
| | c. Unified Power Quality Conditioner (UPQC) | 06 | 04 | 04 | 2.3.1 |

Bharatiya Vidya Bhavan's

# Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058.
Examination: **RE-EXAMINATION (OLD COURSE)**
Academic Year **2019 -20**

Q. P. Code:

Max. Marks: **100** Duration: **03 Hrs**
Class: **BTech (Electrical)** Semester: **VIII** Program: **UG**
Name of the Course: **POWER ELECTRONICS APPLICATION IN POWER SYSTEM**
Course Code : **BTE427**

**Instructions:**
**Answer any five questions (Qs.I to Qs.VII)**
**Assume suitable data & necessary neat diagrams wherever required.**

| Question No | | Maximum Marks | Course Outcome Number | Module Number |
|---|---|---|---|---|
| Qs. I | a. State and explain the objectives of Load Compensation'. Explain, how is load balancing is attained using passive elements for an unbalanced 3-phase complex linear load. Support your answer with neat circuit and phasor diagrams | 20 | 1 | 1 |
| Qs. II | a. Explain the different techniques for Pulse Width Modulation. | 10 | 3 | 2 |
| | b. Explain Indirect current controlled Synchronous Link Converter Var Compensator | 10 | 3 | 2 |
| Qs. III | a. Explain, the V-I characteristics for the following shunt compensators connected to a power system to support the voltage at the bus as the load varies.<br>(i) Thyristor Switched Reactor & Thyristor Controlled Reactor.<br>(ii) Thyristor Switched Capacitor & FC-TCR. | 10 | 2 | 3 |
| | b. Explain the principle of operation of STATCOM . | 10 | 2 | 3 |

| | | | | |
|---|---|---|---|---|
| $Q_s$. IV | a. Explain the different modes of operation of Thyristor Controlled Series Capacitor (TCSC).<br>b. With relevant equivalent circuit and phasor diagram, analytically explain the effect of SSSC and Series Capacitor on power-angle (p-δ) curve. | 10<br>10 | 2<br>3 | 4<br>4 |
| $Q_s$. V | Explain the basic principle & complete control capabilities of Unified Power Flow Controller (UPFC) with neat Schematic / Single line / phasor diagrams. | 20 | 3 | 4 |
| $Q_s$. VI | a. Explain the Various possible HVDC configurations and their advantages and disadvantages.<br>b. Explain the effect of source inductance on a 6-pulse converter. | 10<br>10 | 1<br>2 | 5<br>6 |
| $Q_s$. VII | a. Explain how is Power flow reversal done in HVDC system<br>b. Explain Mode stabilization & Voltage Dependent Current Order Limit | 10<br>10 | 3<br>3 | 7<br>7 |

BharatiyaVidyaBhavan's

# SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)
Munshi Nagar, Andheri (W) Mumbai – 400058

**RE EXAM – JULY 2019 Examinations**

**Program: Electrical Engineering.** **Duration: 03 Hr.**

**Course Code:PE-BTE 804** **Maximum Points:100**

**Course Name: POWER QUALITY & FACTS** **Semester: VIII**

**Note: Answer any five questions out of seven questions. (Qs.1 to Qs.7).**
**Draw neat circuit diagrams wherever necessary to support your answer.**
**Assume suitable data if necessary.**

| Qs.No. | Questions | Points | CO | BL | PI |
|---|---|---|---|---|---|
| Qs.1 | a. Explain the effect of mid-point passive compensation in improving P-δ curve of a two machine system. Justify your explanation analytically with the support of relevant phasor and circuit diagrams & characteristics. | 10 | 01 | 05 | 2.1.3 |
| | b. Explain the following terms:<br>1) Virtual Natural loading<br>2) Compensation by section | 10 | 01 | 03 | 2.1.3 |
| Qs.2 | a. Explain, how is Thyristor Controlled Series Capacitor (TCSC) compensator used to improve the stability of power system. Support your answer with relevant circuit diagrams & three modes of operation, characteristics. | 10 | 02 | 02 | 2.2.2 |
| | b. Compare the V-I characteristics of the following shunt compensators:<br>i. Thyristor switched Reactor -Thyristor Switched Capacitor (TSR-TSC)<br>ii. Fixed Capacitor-Thyristor Controlled reactor (FC-TCR) | 10 | 02 | 02 | 2.2.4 |
| Qs.3 | Explain the following with reference to Voltage Source Inverter | | | | |
| | a. Pulse-Width Modulation techniques | 10 | 02 | 03 | 2.3.1 |
| | b. Illustration of Circuit topology, Switching states and output voltage (for three phase). | 10 | 02 | 02 | 2.3.1 |

| | | | | | |
|---|---|---|---|---|---|
| Qs.4 | Illustrate the complete control strategy of UPFC with the support of basic schematic diagram & phasors | 20 | 02 | 03 | 2.3.2 |
| Qs.5 | a. Eplain the following application of FACTS devices<br>1. Voltage regulation of transmission line mid-point voltage using STATCOM.<br>2. Power flow control using SSSC | 10 | 02 | 02 | 2.3.1 |
| | b. State the classification of power quality issues in power distribution system | 10 | 03 | 01 | 2.2.1 |
| Qs.6 | a. Explain the support of DSTATCOM in voltage regulation. Support your answer with relevant phasor and circuit diagrams. | 10 | 04 | 03 | 2.3.1 |
| | b. Explain the role of Shunt Active Filters in attaining Harmonics mitigation in Distribution Systems? Support your answer with relevant diagrams. | 10 | 04 | 03 | 2.3.1 |
| Qs.7 | With reference to mitigation of power quality issues, how does the following devices support : | | | | |
| | a. Dynamic Voltage Restorer (DVR) | 08 | 04 | 04 | 2.3.1 |
| | b. Series Active Filter (SAF) | 06 | 04 | 04 | 2.3.1 |
| | c. Unified Power Quality Conditioner (UPQC) | 06 | 04 | 04 | 2.3.1 |