**QUESTION BANK**

# Information Assurance & Security

**B.Tech -Information Technology**

## SECTION I

### SHORT ANSWERS

1. Describe the OSI Security architecture?
2. Differentiate between passive and active security threats?
3. Briefly define categories of passive and active security attacks?
4. List and define categories of security services?
5. List and briefly define categories of security mechanisms?
6. What are the essential ingredients of a symmetric cipher?
7. What are the two basic functions used in encryption algorithm ?
8. What is difference between block cipher and stream cipher?
9. List and briefly define types of Cryptanalytic attacks based on what is known to the attacker?
10. Define the Caeser cipher
11. Define playfair cipher?
12. What is the difference between diffusion and confusion?
13. Why is it important to study the Feistel Cipher?
14. What is product Cipher?
15. What is a message authentication code?
16. What is the difference between differential and linear cryptanalysis?
17. What is the difference between Block cipher and Stream Cipher?
18. What is the purpose of the S-boxes in DES?
19. Define Round Structure in Secret Key Cryptography?
20. Describe Feistel Cipher?
21. Define Cryptanalysis?
22. Define Stream Cipher?
23. Define Round Structure?
24. List and briefly define three uses of a public-key cryptosystem.
25. What is a digital signature?
26. List different ticket flags of Kerbores version.5?
27. In the context of Kerbores, what is a realm?
28. What is a public-key certificate?
29. Define version 4?What is Kerbores?
30. Elaborate IPSec .

31. Elaborate Cloud Securitywith Network Access Control with Authentication Protocol.
32. Encapsulating Security Payload
33. Elaboarate Mail & IP Security
34. Short Notes : Pretty Good Privacy
35. Short Note : S/MIME
36. Short Note : IP Security
37. Describe : Encapsulating Security Payload.
38. What is cybercrime ? How do you define it?
39. Define cybercrime and Information Security?
40. Define passive aspects of ITA 2000?
41. How do we classify cybercrimes? Explain each briefly?
42. Elaborate Information Technology Act 2000?
43. Define Weakness of ITA 2000?
44. Define Active aspects of ITA 2000?
45. Define Information Security?
46. Advantages Information Technology Act 2000?
47. Pros and cons of ITA 2000?
48. How cybercrimes are avoided?
49. Define background of ITA2000?
50. Why Information Technology Act 2000?
51. Define types of cyber security?
52. How is cyber security achieved?
53. What are the different phase during the attack on the network?
54. What are the different types of Password cracking?
55. What is the difference between a virus and worm?
56. What is the difference between a proxy server and an anonymizer?
57. What is the difference between a virus and Trozen Horse?
58. Define CyberCrime?
59. What is Trojan Horse and Backdoors?
60. Define Password Cracking?
61. Define Wireless Networks?
62. How can Wireless networks be compromised?
63. Define dimensions of Password cracking?
64. How Criminals Plan the Attacks
65. Describe : Social Engineering, Cyber stalking
66. Describe : DoS and DDoS Attacks
67. Describe SQL Injection
68. Elaborate Attacks on Wireless Networks
69. Describe Phishing and Identity Theft

## LONG ANSWERS

1. Explain the Network Security Model with diagram.
2. Describe IP Security with special mention to IP Security Policy
3. Explain different crypto algorithm where public-key cryptosystem?
4. What are the principle differences between version 4 and version 5?
5. What entities constitute a full-service Kerberos environment?
6. What is Stegnography? Are countermeasures employed against Steganography? Why?
7. List different authentication procedures in X.509 certificate
8. How is MAC different from HMAC?
9. What is the difference between a private key and secret key?
10. Elaborate Information Technology Act 2000?
11. Define Weakness of ITA 2000? Define Active aspects of ITA 2000?
12. Define Information Security?
13. Elaborate Cloud Securitywith Network Access Control with Authentication Protocol.
14. Describe IP Security with special mention to IP Security Policy
15. Encapsulating Security Payload
16. List different ticket flags of Kerbores version.5? In the context of Kerbores, what is a realm?
17. Describe Public Key Infrastructure.
18. Elaborate the strength of DES. Public-Key Cryptography and RSA: Principles of
19. Public Key Cryptosystems with RSA describing of the Algorithm,
20. Solve the following : Identify the public Keys using RSA Algorithms.
21. Mention Challenges to Indian Law and Cyber Crime Scenario in India,
22. Consequences of Not Addressing the Weakness in Information Technology Act.

# COMPUTER NETWORKS

# QUETIONARY

## 4 Marks Questions

1. Compare OSI reference model with TCP/IP protocol suite.
2. Explain logical address in detail.
3. Explain Physical address in detail.
4. Explain Post address and Application specific address in detail.
5. Describe the NAT.
6. Write a short note on user datagram
7. Explain encapsulation & decapsulation in UDP with diagram
8. Write a short note on “Queuing” in UDP
9. Explain TCP services.
10. Explain TCP features.
11. Explain different types of TCP timers.
12. Write a short note on Concurrency.
13. Write a short note on Socket System Call
14. Explain simplified version of socket structure in detail.
15. Describe DHCP and explain need of DHCP.
16. What is Resolution in DNS?
17. Explain NVT with diagram
18. What is MTA? Explain formal protocol which defines the MTA client and server in the
19. Write a short note on Out-of-band signaling
20. Explain the messages used in TFTP.
21. Explain Dynamic Web Document.
22. Explain POP3 with its modes.

23. Explain need for DN
24. S also explain DNS in the Internet with suitable example.
25. Write a short note on  Error control in TCP
26. Write a short note on Flow control in TCP
27. Write a short note on Congestion Control in TCP
28. Explain each and every module of UDP package in detail.
29. Describe the Classless Addressing.
30. Describe the Special Addressing.
31. Explain Post address and Application specific address in detail.

**8 Marks Questions**

1. Explain layers in TCP/IP protocol suite in detail with neat diagram.
2. Explain layers in OSI reference model in detail with neat diagram.
3. What is Three-way handshaking in TCP?
4. Draw State Transition diagram of TCP in detail.
5. Explain Connection–Oriented concurrent server in detail.
6. Explain Connectionless Iterative server in detail.
7. What is FTP? Explain connection in FTP.
8. Explain different domain name space sections of DNS in the internet.
9. Explain client state transition diagram of DHCP.
10. Explain Email architecture with its four scenarios.
11. Explain address allocation in DHCP. Draw DHCP client State transition diagram.
12. Explain connection in TFTP.
13. Explain need for DNS also explain DNS in the Internet with suitable example.

14. What is IP Datagram? Explain with a neat diagram.
15. What is fragmentation? Explain with a neat diagram.
16. Explain in detail pseudo header for checksum calculation with a neat diagram.
17. Explain the connection establishment in TCP connection using three way hands shaking.
18. Explain the different Associations of SCTP.
19. Explain the state transition diagram of SCTP in detail.
20. Write a TCP client-server Program.

# B.E. (Part – II) (New) (CBCS) QUESTION BANK
# Electrical Engineering
# SMART GRID TECHNOLOGY

### Four & Six Mark Questions
### UNIT-I

1. Define smart grid concept and explain its necessity
2. What is smart grid system?
3. Why implement the Smart Grid now?
4. What is the Smart Grid? Overview of How Indian power market is organized, operated and challenges being faced
5. Explain the stages on evaluation of smart grid.
6. Explain the concept of robust and self-healing grid.
7. Explain functions of smart grid components.
8. Explain how the automatic meter reading can make the system smarter.
9. What are the initiatives taken by Indian economy for smart grid?
10. Describe the opportunities and challenges relate to smart grid.
11. Define smart grid. Differentiate between conventional grid and smart grid.
12. Describe the opportunities and challenges relate to smart grid
13. What are the major points which ar6 the forced drivers for demanding smart grid
14. What is the need of Smart Grid? What will be the components of Smart Grid?
15. What are the different opportunities and Barriers of Smart Grid in India
16. Define Smart Grid and give its functions.
17. Give present development and international policies in smart grid.

### UNIT-II

1. Explain smart metering and advantages of it
2. Compare conventional metering and smart metering
3. Explain how the smart meters can be play an important role to make a system smart
4. What is Intelligent Electronic Device (IED)? Explain the functions of IED.
5. Explain the concept of phase measurement unit and also its applications.
6. What are the protocols and benefits of Advanced Metering Infrastructure (AMI)?
7. What is phasor measurement unit? Explain its feature and applications of PMU in power system.
8. Give the brief description of intelligent Electronic Devices (IED).
9. Explain the communication network topologies used for data transmission in advanced metering infrastructure.
10. What are smart energy meters? Explain its function in smart grid.
11. Explain phase measurement unit and its importance in smart grid.
12. Explain the function of IED & their application.
13. Highlight on role of geographic information system (GIS) in smart grid and also give its function.
14. Explain how Smart Appliances can be the part of Smart Grid
15. What is Geographic Information System (GIS)? Explain the components of GIS.
16. Explain wide area measurement system.

## UNIT-III

1. What are the challenges which are being faced for electrifying India's rural community?
2. What are the developing technology and systems that will enable smarter rural electrification?
3. What is a Virtual Power Plant? How can a virtual power plant system contribute to a more sustainable world?
4. What is a virtual power plant platform? What is a solar PV virtual power plant?
5. What is a virtual utility? What are the benefits of a virtual power plant?
6. What is solar power?
7. How many solar panels are needed to power my home?
8. Why is solar power the best?
9. What are the 2 main disadvantages to solar energy?
10. What is geothermal energy?
11. What are disadvantages of geothermal energy?
12. What are advantages of geothermal power?
13. What is utility in smart grid?
14. What is a smart utility?
15. What are three main features of smart grid?
16. What are the six key components of a smart grid?
17. What is smart grid maturity model?
18. What does SGMM mean?

## UNIT-IV

1. Explain the concept of power quality in smart grid
2. Explain the importance of power quality in smart grid.
3. How the power quality can be improved in smart grid.
4. Explain the web based power quality monitoring system.
5. Highlight the issues related to power quality in smart grid.
6. Describe the power quality issues of grid connected renewable energy resources.
7. Explain Electromagnetic Compatibility (EMC). What is the importance of voltage quality to achieve EMC?
8. Describe the concept of power quality conditioners related to smart grid
9. Illustrate power quality monitoring concept and also explain monitoring considerations.
10. Explain the concept of power quality conditioners related to smart grid.
11. Explain role of AMI in Smart Grid.
12. Explain the concept of Power Quality and EMC in Smart Grid.
13. Explain importance of power quality in smart grid & how it can be improved.
14. Explain the protection and control strategy implemented in smart grid.
15. Explain EMC and its importance in smart grid.
16. Explain the power quality audit and its importance in smart grid.
17. Explain the concept WAN related to smart grid.
18. Write a note on 'Web based Power Quality Monitoring'.
19. Describe web based power quality monitoring

## UNIT-V

1. What are power electronics in smart grid?
2. Why power electronics technology is important in the grid connected system?
3. What are power electronics?
4. What energy does smart grid use?
5. How power electronic converters are used in smart grid networks?
6. Why power electronics technology is important in the grid connected system?
7. What is a smart grid how can smart grids be useful?
8. What does a smart power grid do?
9. What is the difference between smart grid and power grid?
10. What is power converter in power electronics?
11. What are the types of converters in power electronics?
12. Where are power electronic converters used?
13. Why power electronics technology is important in the grid connected system?
14. What is EMC in smart grid?
15. What is power electronic converter system?
16. What is difference between STATCOM and DSTATCOM?
17. What are the advantages of STATCOM?
18. What is the main function of DSTATCOM?
19. What is the importance of VI characteristics of STATCOM?

## UNIT-VI

1. How does distribution management system work?
2. What is distribution management system software?
3. What is the difference between OMS and DMS?
4. What is distribution system state the function of the distribution system
5. What are the Visualization Techniques used in Smart Grid system.
6. What is energy management system in smart grid?
7. What is energy management system explain in detail?
8. What are the methods of energy management?
9. What are the categories of energy management systems?
10. How the Survey of Home Energy Management Systems in Future will be carried out by using Smart Grid Communications techniques?

**T.E. (Part - I) (New) (CBCS) Examination May/June-2022**

**Mechanical Engineering**

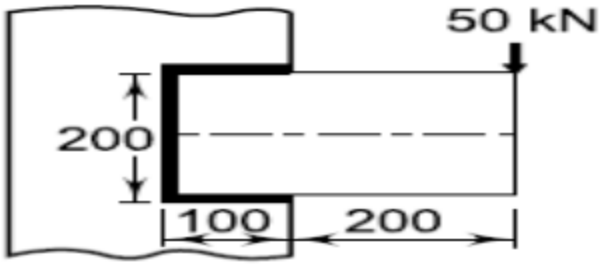
**MACHINE DESIGN – I (Question Bank)**

1. Explain Design Procedure for Cotter joint
2. Explain Design Procedure for Knuckle Joint
3. Define Factor of safety. Explain factor affecting on selection of Factor of safety and its physical significance.
4. Explain design procedure for machine element
5. Differentiate between Rigid Coupling and Flexible Coupling.
6. Explain ASME code used for shaft design
7. Explain the Goodman and Soderberg diagram
8. Differentiate between Flat Belt Drive and V-Belt Drive
9. Explain design procedure for Hollow shaft
10. Explain design procedure for Square key and Flat key
11. Explain design procedure for Muff Coupling
12. Derive the equation for Strength of butt welds
13. Explain design of combined transverse and parallel fillet weld
14. Explain design procedure for Axially loaded unsymmetrical welded joints
15. Explain Terminology used in riveted joints
16. Explain series and parallel springs for finding the Stiffness of Spring
17. It is required to design a cotter joint to connect two steel rods of equal diameter. Each rod is subjected to an axial tensile force of 50 kN. The material is selected as plain carbon steel of Grade 30C8 (Syt = 400 N/mm2). Design the joint and specify its main dimensions. The factor of safety is 6 and assumed that the yield strength in compression is twice the yield strength in tension.
18. Two rods are connected by means of a cotter joint. The inside diameter of the socket and outside diameter of the socket collar are 50 and 100 mm respectively. The rods are subjected to a tensile force of 50 kN. The cotter is made of steel 30C8 (Syt = 400 N/mm2) and the factor of safety is 4. The width of the cotter is five times of thickness. Calculate: (i) width and thickness of the cotter on the basis of shear failure; and (ii) width and thickness of the cotter on the basis of bending failure.
19. Two rods, made of plain carbon steel 40C8 (Syt = 380 N/mm2), are to be connected by means of a cotter joint. The diameter of each rod is 50 mm and the cotter is made from a steel plate of 15 mm thickness. Calculate the dimensions of the socket end making the following assumptions: (i) the yield strength in compression is twice of the tensile yield strength; and (ii) the yield strength in shear is 50% of the tensile yield strength. The factor of safety is 6.
20. A V-belt drive is required for a 15-kW, 1440 rpm electric motor, which drives a centrifugal pump running at 360 rpm for a service of 24 hours per day. From space considerations, the center distance should be approximately 1 m. Take d= 200mm, Fa= 1.2, Pr=6.36. Determine (i) belt specifications; (ii) number of belts; (iii) correct centre distance; and (iv) pulley diameters.
21. It is required to select a V-belt drive to connect a 20-kW, 1440 rpm motor to a compressor running at 480 rpm for 15 hours per day. Space is available for a centre distance of approximately 1.2 m. Determine (i) the specifications of the belt; (ii) diameters of motor and compressor pulleys; (iii) the correct centre distance; and (iv) the number of belts.
22. It is required to select a flat-belt drive for a fan running at 360 rpm which is driven by a 10 kW, 1440 rpm motor. The belt drive is open-type and space is available for a centre distance of 2 m approximately. The belt velocity should be between 17.8 to 22.9 m/s. The power transmitting capacity of the belt per mm width per ply at 180° arc of contact and at a belt velocity of 5.08 m/s is 0.0118 kW. The load correction

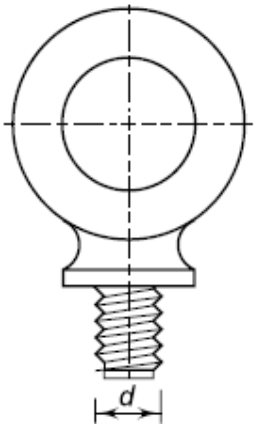
factor can be taken as 1.2. Suggest preferred diameters for motor and fan pulleys and give complete specifications of belting.

23. It is required to select a flat-belt drive to connect two transmission shafts rotating at 800 and 400 rpm respectively. The centre to centre distance between the shafts is approximately 3 m and the belt drive is opentype. The power transmitted by the belt is 30 kW and the load correction factor is 1.3. The belt should operate at a velocity between 17.8 to 22.9 m/s. The power transmitting capacity of the belt per mm width per ply at 180º arc of contact and at a belt velocity of 5.08 m/s is 0.0147 kW. Select preferred pulley diameters and specify the belt.
24. The standard cross-section for a flat key, which is fitted on a 50 mm diameter shaft, is 16 x 10 mm. The key is transmitting 475 N-m torque from the shaft to the hub. The key is made of commercial steel (Syt = Syc = 230 N/mm2). Determine the length of the key, if the factor of safety is 3.
25. A propeller shaft is required to transmit 45 kW power at 500 rpm. It is a hollow shaft, having an inside diameter 0.6 times of outside diameter. It is made of plain carbon steel and the permissible shear stress is 84 N/mm2. Calculate the inside and outside diameters of the shaft.
26. It is required to design a square key for fixing a gear on a shaft of 25 mm diameter. The shaft is transmitting 15 kW power at 720 rpm to the gear. The key is made of steel 50C4 (Syt = 460 N/mm2) and the factor of safety is 3. For key material, the yield strength in compression can be assumed to be equal to the yield strength in tension. Determine the dimensions of the key.
27. Design a muff coupling to connect two steel shafts transmitting 25 kW power at 360 rpm. The shafts and key are made of plain carbon steel 30C8 (Syt = Syc = 400N/mm2). The sleeve is made of grey cast iron FG 200 (Sut = 200 N/mm2). The factor of safety for the shafts and key is 4. For the sleeve, the factor of safety is 6 based on ultimate strength.
28. It is required to design a helical compression spring subjected to a maximum force of 1250 N. The deflection of the spring corresponding to the maximum force should be approximately 30 mm. The spring index can be taken as 6. The spring is made of patented and cold-drawn steel wire. The ultimate tensile strength and modulus of rigidity of the spring material are 1090 and 81370 N/mm2 respectively. The permissible shear stress for the spring wire should be taken as 50% of the ultimate tensile strength. Consider the spring has square and ground end. Design the spring and calculate: (i) wire diameter; (ii) mean coil diameter; (iii) number of active coils; (iv) total number of coils; (v) free length of the spring; and (vi) pitch of the coil.
29. A helical compression spring, made of circular wire, is subjected to an axial force, which varies from 2.5 kN to 3.5 kN. Over this range of force, the deflection of the spring should be approximately 5 mm. The spring index can be taken as 5. The spring has square and ground ends. The spring is made of patented and cold-drawn steel wire with ultimate tensile strength of 1050 N/mm2 and modulus of rigidity of 81370 N/mm2. The permissible shear stress for the spring wire should be taken as 50% of the ultimate tensile strength. Design the spring and calculate (i) wire diameter; (ii) mean coil diameter; (iii) number of active coils; (iv) total number of coils; (v) solid length of the spring; (vi) free length of the spring; (vii) required spring rate; and (viii) actual spring rate
30. A helical tension spring is used in the spring balance to measure the weights. One end of the spring is attached to the rigid support while the other end, which is free, carries the weights to be measured. The maximum weight attached to the spring balance is 1500 N and the length of the scale should be approximately 100 mm. The spring index can be taken as 6. The spring is made of oil-hardened and tempered steel wire with ultimate tensile strength of 1360 N/mm2 and modulus of rigidity of 81370 N/mm2. The permissible shear stress in the spring wire should be taken as 50% of the ultimate tensile strength. Design the spring and calculate (i) wire diameter; (ii) mean coil diameter; (iii) number of active coils; (iv) required spring rate; and (v) actual spring rate.

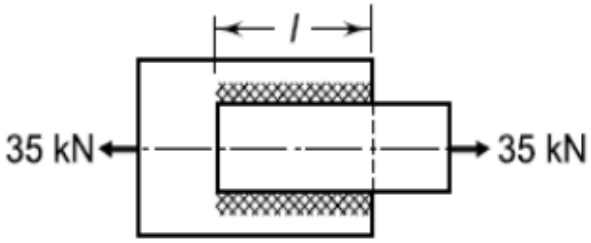
31. A welded connection of steel plates is shown in Fig. It is subjected to an eccentric force of 50 kN. Determine the size of the weld, if the permissible shear stress in the weld is not to exceed 70 N/mm2.



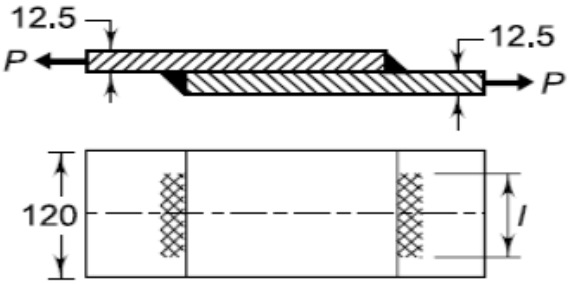

32. An electric motor weighing 10 kN is lifted by means of an eye bolt as shown in Fig. The eye bolt is screwed into the frame of the motor. The eye bolt has coarse threads. It is made of plain carbon steel 30C8 (Syt = 400 N/mm2) and the factor of safety is 6. Determine the size of the bolt.



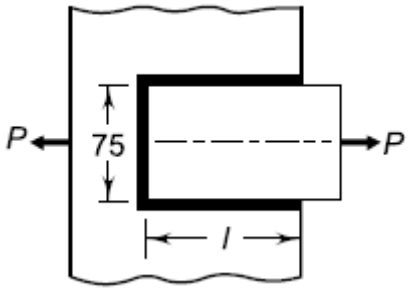

33. Two plates are joined together by means of fillet welds as shown in Fig. The leg dimension of the welds is 10 mm and the permissible shear stress at the throat cross section is 75 N/mm2. Determine the length of each weld, if 15 mm weld length is required for starting and stopping of the weld run.



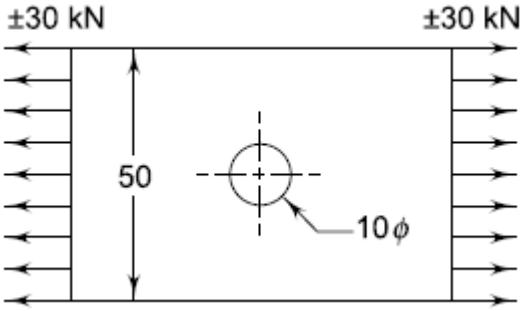

34. Two steel plates of width 120 mm and thickness 12.5 mm are joined together by means of double transverse welds as shown in figure. The welded joint is subjected to a tensile force (P) of 150 KN. Determine the length of the welds, if the allowable tensile stress for weld material is 120 N/mm2



35. A plate, 75 mm wide and 10 mm thick, is joined with another steel plate by means of single transverse and double parallel fillet welds, as shown in Fig. The joint is subjected to a maximum tensile force of 55 kN. The permissible tensile and shear stresses in the weld material are 70 and 50 N/mm2 respectively. Determine the required length of each parallel fillet weld. Consider 15 mm of length for starting and stopping of the weld run.




36. A plate made of steel 20C8 (Sut = 440 N/mm2) in hot rolled and normalized condition is shown in Fig. It is subjected to a completely reversed axial load of 30 kN. The notch sensitivity factor q can be taken as 0.8 and the expected reliability is 90%. The size factor is 0.85. The factor of safety is 2. Determine the plate thickness for infinite life. Take Ka=0.67, Kb=0.85, For 90% reliability, Kc=0.897, Kt=2.51



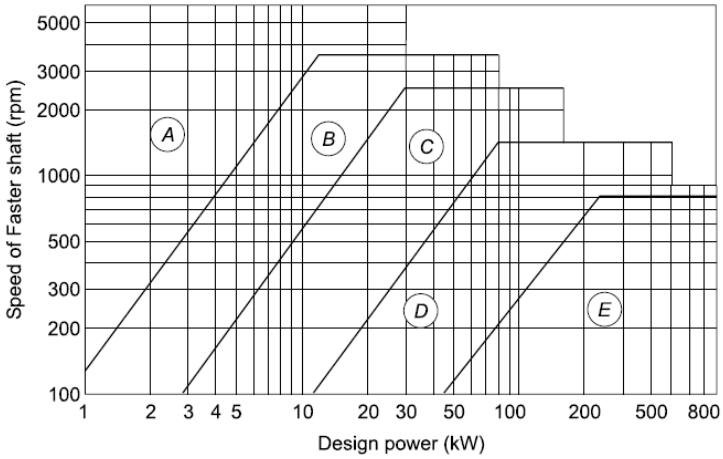




**Table 13.22** *Correction factor for arc of contact ($F_d$)*

| $\frac{D-d}{C}$ | *Arc of contact on smaller pulley (in degrees)* | *Correction Factor $F_d$* |
|---|---|---|
| 0.00 | 180 | 1.00 |
| 0.05 | 177 | 0.99 |
| 0.10 | 174 | 0.99 |
| 0.15 | 171 | 0.98 |
| 0.20 | 169 | 0.97 |
| 0.25 | 166 | 0.97 |
| 0.30 | 163 | 0.96 |
| 0.35 | 160 | 0.95 |
| 0.40 | 157 | 0.94 |
| 0.45 | 154 | 0.93 |
| 0.50 | 151 | 0.93 |
| 0.55 | 148 | 0.92 |
| 0.60 | 145 | 0.91 |
| 0.65 | 142 | 0.90 |
| 0.70 | 139 | 0.89 |
| 0.75 | 136 | 0.88 |
| 0.80 | 133 | 0.87 |
| 0.85 | 130 | 0.86 |
| 0.90 | 127 | 0.85 |
| 0.95 | 123 | 0.83 |
| 1.00 | 120 | 0.82 |

**Table** *Nominal pitch lengths for standard sizes of V-belts*

| *Pitch lengths of belts $L_p$ (mm)* | | | | | |
|---|---|---|---|---|---|
| *Z* | *A* | *B* | *C* | *D* | *E* |
| 405 | 630 | 930 | 1560 | 2740 | 4660 |
| 475 | 700 | 1000 | 1760 | 3130 | 5040 |
| 530 | 790 | 1100 | 1950 | 3330 | 5420 |
| 625 | 890 | 1210 | 2190 | 3730 | 6100 |
| 700 | 990 | 1370 | 2420 | 4080 | 6850 |
| 780 | 1100 | 1560 | 2720 | 4620 | 7650 |
| 920 | 1250 | 1690 | 2880 | 5400 | 9150 |
| 1080 | 1430 | 1760 | 3080 | 6100 | 12230 |
| 1330 | 1550 | 1950 | 3310 | 6840 | 13750 |
| 1420 | 1640 | 2180 | 3520 | 7620 | 15280 |
| 1540 | 1750 | 2300 | 4060 | 8410 | 16800 |
| | 1940 | 2500 | 4600 | 9140 | |
| | 2050 | 2700 | 5380 | 10700 | |
| | 2200 | 2870 | 6100 | 12200 | |
| | 2300 | 3200 | 6820 | 13700 | |
| | 2480 | 3600 | 7600 | 15200 | |
| | 2570 | 4060 | 9100 | | |
| | 2700 | 4430 | 10700 | | |
| | 2910 | 4820 | | | |
| | 3080 | 5370 | | | |
| | 3290 | 6070 | | | |
| | 3540 | | | | |

**Table 13.21** *Correction factors for belt pitch length ($F_2$)*

| *Correction Factor* | *Belt pitch length (mm)* *Belt cross section* | | | | | |
|---|---|---|---|---|---|---|
| | *Z* | *A* | *B* | *C* | *D* | *E* |
| 0.80 | | 630 | | | | |
| 0.81 | | | 930 | | | |
| 0.82 | | 700 | | 1560 | 2740 | |
| 0.83 | | | 1000 | | | |
| 0.84 | | 790 | | 1760 | | |
| 0.85 | | | 1100 | | | |
| 0.86 | 405 | 890 | | | 3130 | |
| 0.87 | | | 1210 | 1950 | 3330 | |
| 0.88 | | 990 | | | | |
| 0.89 | | | | | | |
| 0.90 | 475 | 1100 | 1370 | 2190 | 3730 | 4660 |
| 0.91 | | | | 2340 | | |
| 0.92 | 530 | | 1560 | 2490 | 4080 | 5040 |
| 0.93 | | 1250 | | | | |
| 0.94 | | | | 2720 | 4620 | 5420 |
| 0.95 | 625 | | 1760 | 2800 | | |
| 0.96 | | 1430 | | 3080 | | 6100 |
| 0.97 | | | 1950 | | 5400 | |
| 0.98 | 700 | 1550 | | 3310 | | |
| 0.99 | | 1640 | 2180 | 3520 | | 6850 |
| 1.00 | 780 | 1750 | 2300 | | 6100 | |
| 1.02 | | 1940 | 2500 | 4060 | | 7650 |
| 1.03 | | | | | 6840 | |
| 1.04 | 920 | 2050 | 2700 | | | |
| 1.05 | | 2200 | 2850 | 4600 | 7620 | 9150 |
| 1.06 | | 2300 | | | | |
| 1.07 | 1080 | | | | 8410 | 9950 |
| 1.08 | | 2480 | 3200 | 5380 | | |
| 1.09 | | 2570 | | | 9140 | 10710 |
| 1.10 | | 2700 | 3600 | | | |
| 1.11 | | | | 6100 | | |
| 1.12 | | 2910 | | | 10700 | 12230 |
| 1.13 | | 3080 | 4060 | | | |
| 1.14 | | 3290 | | 6860 | | 13750 |
| 1.15 | | | 4430 | | | |
| 1.16 | | 3540 | 4820 | 7600 | 12200 | |
| 1.17 | | | 5000 | | 13700 | 15280 |
| 1.18 | | | 5370 | | | |

# Punyashlok Ahilyadevi Holkar Solapur University,Solapur
## Department Electrical Engineering
## CLASS: T.Y. (Part – II) (New) (CBCS)
## Subject : ELECTRICAL UTILIZATION

## Question Bank (EU)

**1)** Explain series-parallel control.
**2.)** A train is required to run between two stations 1.6 km apart at an average speed of 40 kmph. The run is to be made to a simplified quadrilateral speed-time curve. If the maximum speed is limited to 64 kmph, acceleration to 2.0 kmphps, coasting and braking retardation to 0.16 kmphps and 3.2 kmphps, determine the duration of acceleration, coasting and braking periods.
**3.)** Write short note on motor selection in textile industries.
**4.)** Explain mono rail system.
**5.)** Classify transition methods. Explain shunt transition in detail.
6. Describe with the help of a neat diagram the construction and working of a high pressure mercury vapour lamp.
7. What do you understand by direct, indirect and semi-indirect lighting?
8. Explain the method of induction heating and describe coreless type of induction furnaces.
**9.** Derive an expression for Trapezoidal Speed-Time Curve.
**10** An electric train has an average speed of 42 km/h on a level track between stops 1,400 m apart. It is accelerated at 1.7 km/h/s and is braked at 3 km/h/s. Estimate the energy consumption at the axle of the train per tonne-km. Take tractive resistance constant at 50 N per tonne and allow 10% for rotational inertia.
**11.** Explain train lighting system.
12. Explain with a neat sketch how the spot welding is carried out by a spot welding machine.
13. A 250 V lamp has a total flux of 2500 lumens and takes a current of 0.7 A. Calculate

(a) lumens/watt
(b) M.S.C.P./watt

14. Explain the principle of direct and indirect core type induction furnace.
**15.** Explain the laws of illumination.
**16.** Explain energy conservation in households.
**17.** Explain direct and indirect resistance heating techniques.
**18.** Explain the following terms:
i) Luminous Flux
ii) Illumination iii) Brightness iv) Glare
19. What is dielectric heating? Explain the factors on which the dielectric loss in a dielectric material depends.
20. A hall measuring 27.5m x 45.75m is to be illuminated using 250 watt filament lamps. The luminous efficiency of the 250 watt filament lamp is 14.4 lumens/watt. Inside the hall an average illumination of 108 lumens/$m^2$ is to be provided on the working plane. The walls and ceiling are brightly painted. Take coefficient of utilization s 0.35 and depreciation factor as 0.9. Calculate the number of lamps required for this.
21. Discuss in detail the principle of operation of (i) Ultrasonic welding and (ii) Laser welding.

22. Explain quadrilateral speed time curve. Derive the expression for total distance in km.

23. Explain the requirements of ideal traction system

24. Derive an expression for tractive effort for propulsion of train

25. A train is required to run between two stations 1.6 km apart at an average speed of 40 km/h. The run is to be made to a simplified quadrilateral speed-time curve. If the maximum speed is to be limited to 64 km/h, acceleration to 2.0 km/h/s and coasting and braking retardation to 0.16 km/h/s and 3.2 km/h/s respectively, determine the duration of acceleration, coasting and braking periods

26. What do you mean by "Electric traction"? What are the requirements of an ideal traction system? How are they met in an electric traction system?

27. What are the various traction systems in practice in our country? Give the advantages of electric drives with its limitations and discuss briefly the factors governing the final choice of traction system.

28. What do you understand by speed-time curves? What is its use in practice? Explain clearly 'free running', 'coasting' and 'braking' with reference to electric traction systems.

29. Explain speed-time curve of a train running on main line. Define 'crest speed', 'average speed' and 'schedule speed'.

30. Derive a suitable equation to determine Vm from a simplified speed-time curve

31.An electric train accelerates uniformly from rest to a speed of 48kn/hour in 24 seconds .It then coasts for 69 seconds against a constant resistance of 58 N/tonne and is braked to rest at 3.3km/hour/second in11 seconds. Calculate i) the acceleration ii) coasting retardation and iii)the schedule speed of reducing the station stops are 20 second duration. What would be the effect on schedule speed of reducing the station stops to 15 second duration, other conditions remaining same .Allow 10% for rotational inertia.

32. Describe the procedure of calculating the specific energy consumption of an electric train.

33. Discuss briefly different systems of traction.

34. Explain the requirements of ideal traction system.

35. Explain quadrilateral speed -time curve. Derive the expression for total distance in km .

36. Explain specific energy consumption of train .Discuss the various factors affecting it.

37. Write short notes on the following.

a. Factors affecting energy consumption in propelling a train.
b. Mechanics of 'train movement'
c. Dead weight, accelerating weight and adhesive weight of a train
d. Tractive effort for propulsion of train

38. A schedule speed of 45km/h is required between two stops 1.5 km apart. Find the maximum speed over the run if the stop is of 20 second duration. The values of acceleration and retardation are 2.4 km/h/s and 3.2 km/h/s respectively. Assume a simplified trapezoidal speed time curve.

38. Describe the procedure of calculating the specific energy consumption of an electric train.

39. Explain the following terms: a) Adhesive weight b) Coefficient of adhesion c) Accelerating weight.

40. Explain mechanical regenerative braking.

41. Write a short note on auxiliary equipment in traction system.

42. Explain dielectric heating and write down advantages of dielectric heating.

43. With the diagram explain laser welding.
44. With the diagram explain ultrasonic welding.
45. Define the terms: luminous flux, luminous intensity, candle power, illumination, lux
46. With neat diagram explain MV lamp and SV lamp
47. Define the terms: Reduction factor, lamp efficiency, glare, space-height ratio, utilization factor.
48. Write short note on Energy conservation in small scale industries.
49. Write short note on

a. Energy conservation in transport
b. Energy conservation in Agriculture

50. Write a short note on mechanics of train movement.
51. Write a note on electrical braking with neat diagram.
52. Explain trapezoidal speed time curve. Derive the expression for total distance in km.
53. Explain crest speed, average speed, and schedule speed and discuss factors affecting scheduled
Speed of time.
54. Write short note on motor selection in rolling mills and textile industries.
55. With the neat diagram explain series-parallel control of DC traction motors.
56. Write short note on motor selection in sugar mills.
57. Classify the transition method. Explain open circuit transition in detail.
58. Explain direct resistance and indirect resistance heating
59. Write a short note on direct and indirect arc furnace.
60. With neat diagram explain induction heating.
61. Explain the comparison between DC welding and AC welding
62. Explain the principles of energy conservation and Write short note on energy conservation in household.
63. State and explain laws of illumination
64. Write short note on street lighting and flood lighting
65. Explain the comparison between tungsten filaments lamps and fluorescent tubes.

## Unit no.1 ODE of First order and Degree and Application

**Type Non -Homogeneous Differential Equation** **3M**

1 Solve: $\frac{dy}{dx}=\frac{6x-2y-7}{3x-y+4}$

2 Solve: $\frac{dy}{dx}=\frac{2x-6y-3}{x-3y+6}$

3 Solve: $(3y+2x+4)dx-(4x+6y+5)dy=0$

4 Solve: $(4x-6y-1)dx+(3y-2x-2)dy=0$

5 Solve: $(2x-2y+5)dy=(x-y+3)dx$

**Type Exact Differential Equation** **3M**

1 Solve: $(sinx\,cosy+e^{2x})dx+(cosx\,siny+tany)dy=0$

2 Solve: $(e^{y}+2)sinx\,dx-e^{y}\,cosx\,dy=0$

3 Solve: $(secx\,tanx\,tany-e^{x})dx+(secx\,sec^{2}y)dy=0$

4 Solve: $(x+1)dy=(y+e^{3x}(x+1)^{2})dx$

5 Solve: $(x^{4}-2xy^{2}+y^{4})dx-(2x^{2}y-4xy^{3}+siny)dy=0$

**Type Reducible to Exact Differential Equation** **3M**

1 Solve: $y(2xy+e^{x})dx-e^{x}dy=0$

2 Solve: $(x^{4}e^{x}-2mxy^{2})dx+2mx^{2}y\,dy=0$

3 Solve: $(2x+e^{x}logy)ydx+e^{x}dy=0$

4 Solve: $(xsec^{2}y-x^{2}cosy)dy=(tany-3x^{4})dx$

5 Solve: $(y^{4}+2y)dx+(xy^{3}+2y^{4}-4x)dy=0$

**Type Linear Differential Equation** **3M**

1 Solve: $\frac{dy}{dx}+\frac{2x}{x^{2}+1}y=\frac{4x^{2}}{x^{2}+1}$

2 Solve: $(x+y+1)\frac{dy}{dx}=1$

3 Solve: $(1+x^{2})dy=(e^{\tan^{-1}x}-y)dx$

4 Solve: $(1+y^{2})dx=(\tan^{-1}y-x)dy$

5 Solve: $\frac{dy}{dx}+y\,tanx=x^{2}\cos^{2}x$

**Type Reducible to Linear Differential Equation** **3M**

1 Solve: $y\log y\frac{dy}{dx}+x-\log y=0$

2 Solve: $\frac{dy}{dx}+\frac{y}{x}logy=\frac{y}{x^{2}}(logy)^{2}$

3 Solve: $x\frac{dy}{dx}+siny\,.\,cosy=x^{3}\cos^{2}y$

4 Solve: $\frac{dy}{dx}+y\,tanx=y^3\,sec\,x$

5 Solve: $x\frac{dy}{dx}+y=x^3\,y^6$

**Type Orthogonal Trajectories** **3M**

1 Find the orthogonal trajectories of the following curve:
$2x^2+y^2=cx$

2 Find the orthogonal trajectories of the following curve:
$x^2+y^2-2ax=0$

3 Find the orthogonal trajectories of the following curve:
$i$ ¿ $xy=a^2$ ii) $a\,y^2=x^3$

4 Find the orthogonal trajectories of the following curve:
$y^2=4ax$

5 Find the orthogonal trajectories of the following curve:
$r^n=a^n\cos n\theta$

6 Find the orthogonal trajectories of the following curve:
$r=a$ ¿

7 Find the orthogonal trajectories of the following curve:
$r^2=a^2\cos 2\theta$

**Type Mechanical and Electrical Engineering Applications** **5M**

1 When a switch is closed, the current built up in an electric circuit is given by $L\frac{di}{dt}+Ri=E$ if L=640 , R=250, E=500, and i=0 when t=0 . Show the current will approach 2 amp. When t→ ∞.

2 A constant emf E volts is applied to a circuit containing a constant resistance R ohms in series and a constant inductance L henries. The current i at any time t is given by $L\frac{di}{dt}+Ri=E$ . If the initial current is zero, show that the current builds up to half its theoretical maximum value in $\frac{L}{R}\log 2$ seconds.

3 If $\frac{dq}{dt}=\frac{E}{R}.\left(1-e^{\frac{-t}{CR}}\right)$ find q at any time t.

4 The charge q on the plate of the condenser of capacity C, charged through a resistance R by a steady voltage V satisfies the differential equation $R\frac{dq}{dt}+\frac{q}{C}=V$. And q=0 when t=0 . Show that **q** $=C.V.\left(1-e^{\frac{-t}{CR}}\right)$.

5 State the Newton's law of cooling. At a room temperature of 25° C , the temperature of a body is 75° C. After 15 seconds the temperature of body was found to be 65° C. Find its temperature after 90 seconds.

6 State the Newton's law of cooling. Water at temperature 100° C cools down in a 10 minutes to 88° C in a room temperature 25° C. Find the temperature of water after 20 minutes.

**7** State the Newton's law of cooling. During what time will a body heated to 100° C cools to 30° C. If the temperature of the room is 20° C and the body

cooled to 60° C in first 20 Minutes.

## Unit no.2 Infinite series

**Type** **Type-I** 3 M

1 Test the convergence of $\sum_{n=1}^{\infty}(\sqrt{n^3+1}-\sqrt{n^3})$ by using comparison test.

2 Test the convergence of $\sum_{n=1}^{\infty}\frac{n^3+2}{2^n+2}$ by using D Alembert's test.

3 Test the convergence of $\sum_{n=1}^{\infty}\frac{n!\,4^n}{(n+1)^n}$ by using D' Alemberts ratio test.

4 By Cauchy's test examine the convergence of $\sum(1+\frac{1}{n})^{n^2}$

5 By Cauchy's test examine the convergence of $\sum u_n = ¿ \sum\left(\frac{1}{n}\right)^n ¿$

**Type** **Type-II** 3 M

1 Test the convergence of $\sum\frac{n-1}{(n^2+1)\sqrt{n+2}}$

2 Test the convergence of $1+\frac{x}{2}+\frac{x^2}{3^2}+\frac{x^3}{4^3}+\ldots+\frac{x^{n-1}}{n^{n-1}}+\ldots \quad x>0$

3 Examine the convergence of $\sum\sin^3(\frac{1}{n})$

4 Examine the convergence of following series:

$$\sum u_n=\frac{1}{1\times 2}+\frac{1}{3\times 4}+\frac{1}{5\times 6}+\ldots$$

5 Examine the convergence of following series:

$$\sum u_n = ¿ \sum\left(1+\frac{1}{n}\right)^{-n^2} ¿$$

**Type** **Absolute and conditional convergence** 5M

1 Define absolute and conditional convergence .Examine the convergence of the series $-\frac{1}{2}+\frac{2}{5}-\frac{3}{10}+\ldots+(-1)^n\frac{n}{n^2+1}+\ldots$

2 Define absolute and conditional convergence. Examine for absolute and

conditional convergence of $\frac{1}{2}-\frac{1}{4}+\frac{1}{6}-\frac{1}{8}+\ldots+\frac{(-1)^{n-1}}{2n}+\ldots$

3 Define absolute and conditional convergence.

Examine for absolute and conditional convergence $\sum_{n=1}^{\infty}\frac{cosn\pi}{n^2+1}$

4 Define absolute and conditional convergence. Examine whether the series $5-\frac{10}{3}+\frac{20}{9}-\frac{40}{27}+\ldots$ is absolute and conditional convergence.

5 Define absolute and conditional convergence .Examine the convergence of the series

$$\sum u_n=\frac{-1}{2}+\frac{2}{5}-\frac{3}{10}+\ldots+\frac{(-1)^n n}{n^2+1}+\ldots$$

## Unit no.3 Complex Variable

**Type Roots of Algebraic Equation** **3M**

1 Find all the values of $(1+i)^{\frac{1}{4}}$

2 Find all the values of $x^4=(1-i)$

3 Find all the values of $x^5=(1+i)$

4 Solve $x^4+1=0$

5 Solve $x^6-i=0$

6 Find all the values of $(\frac{1}{2}+i\frac{\sqrt{3}}{2})^{\frac{3}{4}}$ Also Show that continued product of these value is 1

**3M**

**Type Analytic Function**

1 Show that the function $z^2+z$ is analytic function And find $f'(z)$.

2 Show that the function $sinz$ is analytic function And find $f'(z)$.

3 Show that the function $logz$ is analytic function And find $f'(z)$.

4 Determine constant a, b, c, d if;
$f(z)=x^2+2axy+by^2+i(Cx^2+2dxy+y^2)$ is analytic.

5 Determine constant k if;
$f(z)=\frac{1}{2}\log(x^2+y^2)+i\tan^{-¿(\frac{ky}{x})¿}$ is analytic.

**Type Construct f(z) if u or v is given** **3M**

1 Construct an analytic function whose real part is $(x^2-y^2)$ hence find its imaginary part.

2 Construct an analytic function whose real part is
$(x^2+y^2-5x+y+2)$

3 Construct an analytic function whose imaginary part is $\tan^{-1}(\frac{y}{x})$

4 Construct an analytic function whose imaginary part is $cosx\,sinhy$

5 Construct an analytic function whose imaginary part is $sinhx\,siny$

**Type Harmonic function and conjugate** **5M**

1 Prove that the function $u=x^3-3xy^3+3x^2-y^2+1$ is satisfies Laplace equation and construct the analytic function f(z)

2 Prove that $u=e^x cosy$ is harmonic. Determine its conjugate v and the analytic function f(z)

3 Prove that $v=3x^2y+6xy-y^3$ is harmonic function and construct the analytic function f(z)

4 Prove that $u=cosx\,sinhy$ is harmonic function and construct the analytic function f(z)

5 Prove that $v=sinhx\,siny$ is harmonic function and construct the analytic function f(z)

## Unit no.4 Integral Calculus

**Type Gamma Function** **3M**

1 Solve $\int_0^\infty 7^{-4x^2}dx$

2 Solve $\int_0^1 (x\log x)^4 dx$

3 Solve $\int_0^\infty \sqrt{x}\,e^{-x^3}dx$

4 Solve $\int_0^\infty x^7 e^{-h^2x^2}\mathrm{dx}$

5 Solve $\int_0^\infty \frac{x^7}{7^x}dx$

**Type Beta function Type-I** **3M**

1 Solve $\int_0^1 x^4(1-x)^{\frac{3}{2}}dx$

2 *Evaluate* $\int_3^7 \sqrt[4]{(x-3)(7-x)}\,dx$

3 Solve $\int_0^4 x^2\sqrt{4x-x^2}\ \mathrm{dx}$

4 *Evaluate* $\int_0^1 x^5(1-x^3)^{10}dx$

5 *Evaluate* $\int_0^1 x^4(8-x^3)^{\frac{-1}{3}}dx$

**Type Beta function Type-II** **5M**

1 Evaluate $\int_0^{\pi} x \sin^5 x \cos^8 x \, dx$

2 Prove that $\beta(m, m).\beta(m+\frac{1}{2}, m+\frac{1}{2}) = \frac{\pi}{2^{4m-1}}\frac{1}{m}$.

3 State & Prove Duplication formula.

4 Define $\beta$ function & Evaluate $\int_0^{\infty} \frac{dx}{1+x^4}$

5 Prove that $\beta(m,n) = \int_0^{\infty} \frac{y^{n-1}}{(1+y)^{m+n}} dy$

**Type DUIS Rule** **3M**

1 Evaluate $\int_0^1 \frac{x^{\alpha}-1}{\log x} dx$ , $\alpha \geq 0$

2 Evaluate $\int_0^1 \frac{x^a - x^b}{\log x} dx$

3 Evaluate $\int_0^{\infty} \frac{e^{-x}}{x}(1-e^{-ax}) dx$ where a is parameter

4 Prove that $\int_0^{\infty} \frac{(1-e^{-ax})}{x} e^{-x} dx = \log(a+1)$ where a is a parameter.

5 Evaluate $\int_0^{\infty} \frac{\log(1+a x^2)}{x^2} dx, (a>0)$

## Unit no. 5: Curve Tracing

**Type Cartesian curve** **5M**

**1** Trace the following curve with full justification:
$y^2(2a-x) = x^3$

**2** Trace the following curve with full justification:
$y^2(a-x) = x^2(a+x)$

**3** Trace the following curve with full justification:
$y^2(a^2 + x^2) = x^2(a^2 - x^2)$

**4** Trace the following curve with full justification:
$x^2y^2 = a^2(y^2 - x^2)$

**5** Trace the following curve with full justification:
$(a^2 + x^2)y = a^2 x$

**Type Parametric Curve** **3M**

**1** Trace the following curve with full justification:

$x = a(\theta + \sin\theta)$ , $y = a(1 + \cos\theta)$

**2** Trace the following curve with full justification:
$x = a(t - \sin t)$ , $y = a(1 + \cos t)$

**3** Trace the following curve with full justification:
$x = a(\theta + \sin\theta)$ , $y = a(1 - \cos\theta)$

**4** Trace the following curve with full justification:
$x = a(t - \sin t)$ , $y = a(1 - \cos t)$

**5** Trace the following curve with full justification:
$x = a\{\cos t + (1/2)\log[\tan^2(t/2)]\}$ , $y = a\sin t$

**Type Polar Curve** **3M**

**1** Trace the following curve with full justification:
$r = a\cos 2\theta$

**2** Trace the following curve with full justification:
$r = a\sin 2\theta$

**3** Trace the following curve with full justification:
$r = a\cos 3\theta$

**4** Trace the following curve with full justification:
$r = a(1 + \cos\theta)$

**5** Trace the following curve with full justification:
$r = a\sin 3\theta$

## Unit no. 6: Multivariable integral calculus

**Type Double Integration** **3M**

**1** Evaluate $\int_0^1 \int_0^x xy\left(x^2 y + x y^2\right) dy\, dx$

**2** Evaluate $\int_0^1 \int_0^{x^2} x\left(x^2 + y^2\right) dy\, dx$

**3** Evaluate $\int_0^5 \int_{2-x}^{2+x} dy\, dx$

**4** Evaluate $\int_0^{\pi} \int_0^{a\sin\theta} r\, d\theta\, dr$

**5** Evaluate $\int_0^{\frac{\pi}{2}} \int_0^{a\cos\theta} r^2\, d\theta\, dr$

**Type Double Integration over given region** **3M**

**1** Evaluate $\iint e^{3x+4y}\,dx\,dy$ ,over the triangle $x=0,\ y=0,\ x+y=1.$

**2** Evaluate $\iint_R (x¿¿2+y^2)dx\,dy¿$ over the area of triangle whose vertices are (0, 1), (1, 1), (1, 2).

**3** Evaluate $\iint_R xy(x+y)\,dx\,dy$ where R is region bounded by $x^2=y \wedge x=y.$

**4** Evaluate $\iint x(x-y)\,dxdy$ over R Where R is the triangle with vertices (0 ,0) , (1 , 2) , (0 , 4) .

**5** Evaluate $\iint_R x^2y^2\,dx\,dy$ over the area of circle $x^2+y^2=1.$

**Type** **Change the order of Integration** **3M**

**1** Evaluate $\int_0^{\pi}\int_x^{\pi} \frac{siny}{y}\,dy\,dx$

**2** Evaluate $\int_0^{\pi/2}\int_x^{\pi/2} \frac{cosy}{y}\,dx\,dy$

**3** Change the order of integration & evaluate $\int_3^5\int_0^{\frac{4}{x}} xy\,dy\,dx.$

**4** Change the order of integration & evaluate $\int_0^1\int_{\sqrt{x}}^1 e^{\left(\frac{x}{y}\right)}\,dx\,dy$

**5** Change the order of integration & evaluate $\int_1^2\int_1^{x^2} (\frac{x^2}{y}¿¿)dx\,dy¿¿$

**Type** **Double Integration by Change into polar** **3M**

**1** Change to polar co-ordinates & evaluate $\int_0^{\sqrt{2}}\int_0^{\sqrt{2-y^2}} \log\left(x^2+y^2\right)dx\,dy$

**2** Evaluate by changing to polar coordinates $\int_0^2\int_0^{\sqrt{2x-x^2}} y\sqrt{x^2+y^2}$ dxdy

**3** Evaluate by changing to polar coordinates $\int_0^a\int_0^x \frac{(x^3)\,dx\,dy}{\sqrt{\left(x^2+y^2\right)}}$

**4** Change to polar and evaluate $\int_0^{\frac{a}{\sqrt{2}}}\int_y^{\sqrt{a^2-y^2}} \log\left(x^2+y^2\right)dx\,dy.$

**5** Evaluate by changing to polar co-ordinates $\int_0^{4a}\int_{y^2/4a}^{y} \frac{x^2-y^2}{x^2+y^2}\,dx\,dy$

**Type** **Triple Integration** **3M**

**1** Evaluate: $\int_0^1 \int_{y^2}^1 \int_0^{1-x} x\,dz\,dx\,dy$.

**2** Evaluate $\int_0^a \int_0^{a-x} \int_0^{a-x-y} x^2\,dx\,dy\,dz$

**3** Evaluate $\int_0^{\log 2} \int_0^x \int_0^{x+y} e^{x+y+z}\,dx\,dy\,dz$

**4** Evaluate $\int_0^1 \int_0^{1-x} \int_0^{x+y} e^z\,dx\,dy\,dz$

**5** Evaluate $\int_0^a \int_0^x \int_0^{\sqrt{x+y}} z\,dx\,dy\,dz$

**Type** **Area by double Integration** **5M**

**1** Find the area common to the parabolas $y^2=4ax$ and $x^2=4ay$ by double integration

**2** Find total area of the Astroid $x^{\frac{2}{3}}+y^{\frac{2}{3}}=a^{\frac{2}{3}}$

**3** Find by double integration the area inside the cardioid r= 2a (1+cosθ¿& outside the parabola r= 2a/ (1+cosθ¿.

**4** Find the area outside the circle r = a and inside the cardioid r= a(1+cosθ¿ by double integration

**5** Find the double integration of the area bounded by the parabola $y^2$ =4x and the line
y = 2x-4.

**Type** **Mass of lamina** **5M**

**1** Find the mass of the lamina bounded by the $y^2=ax$and $x^2=ay$,if density of the lamina at a point varies as the square of its distance from the origin .

**2** Find the mass of the lamina bounded by the curve $y^2=x^3$and the line $y=x$. If density of the at any point varies as the distance of the point from the x−¿ axis .

**3** Find the mass of the lamina bounded by the curve 4 $y^2=x^3$and the line $y=x$ ,if density of the lamina at a point varies as the square of distance of the point from the x−¿axis .

**4** A lamina is bounded by $y=x^2$ and y=2x . if the density of any point is given by xy , then find the mass of lamina .

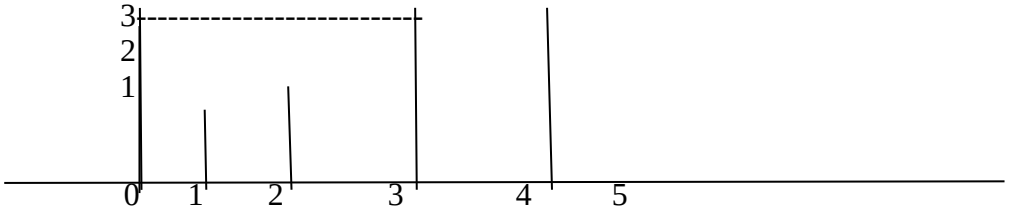
**5** The density of uniform circular lamina of radius ‘a’ various as the square of its density from a fixed point on the circumference of the circle r=2acosθ. Find the mass of the lamina

# T.E. (Part – II) (New) (CBCS) QUESTION BANK
## Electrical Engineering
## SIGNALS & SYSTEM

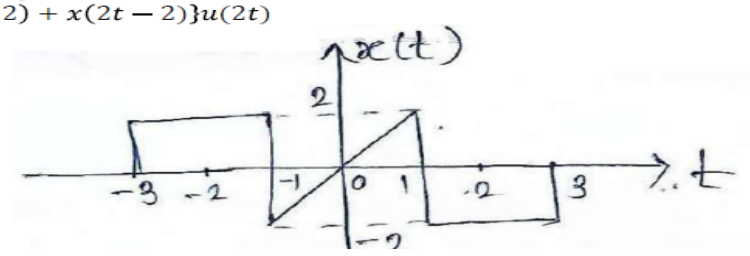
Section-I

UNIT-I, II & III

1. Derive the expression for even and odd components of DT signal x[n].
2. State condition for periodicity (CT& DT) and find the fundamental time period of signal x (t). x(t)= 14 sin(2pi/3)t * cos(4pi/5)t.
3. Calculate energy and power of the following signal x(t)=A cos ($\omega$0t+$\theta$)
4. Prove that sine wave is a periodic signal. $x$(t)=A sin $\omega$0t.
   Check whether the following signals are periodic. If periodic, find the fundamental time period. i) $x(t)=\cos(60\pi t)+\sin(50\pi t)$ ii) $x(n)= e^{j(2\pi/2)n} + e^{j(2\pi/4)n}$
5. A discrete Time signal x(n) is shown, Sketch and label each of the following signal :
   i) x(n – 2)) ii) x(2n) iii) x(–n) iv) x(–n + 2)




6. Determine whether following signal is periodic or non-periodic. If Periodic, determine its Fundamental period : i) x(t) = $\sin^2 t$ ii) x(n) = $e^{j(\pi/4)n}$
7. Define energy and power signal. Determine whether following signal is energy or power signal or neither energy or power signal a) x (n) = u (n) b) x(n) = $(-0.5)^n$ u(n). And find its energy or power.
8. Determine the energy and power of the signal.
   $x(t) = 14\sin(2\pi t), -\infty < t < \infty$
9. Determine whether the given signals $x[n]$ or $x[t]$ are casual or non-casual signals.
   1) $x[n] = u[-2n+3] + u[\frac{-n}{2}]$
   2) $x(t) = u(2t)r(t-2) + u(t+3)r(-t)$
10. Determine and sketch the response of CT-LTI system having impulse response $h(t)$ with an input signal $x(t)$ as shown in figure below.
    $x(t) = \begin{cases} 5, & 0 \le t \le 2 \\ 0, & otherwise \end{cases}$ $h(t) = \begin{cases} 2, & 1 \le t \le 3 \\ 0, & otherwise \end{cases}$
    Check the general properties of the system governed by the equation
    $y[n] = n\,x[5n]$
    Sketch the following signals for given $x(t)$
    1) $x(\frac{t}{2}+3)$
    2) $x(-2-\frac{t}{3})$
    3) $\{x(t-2)+x(2t-2)\}u(2t)$



12. Derive the expression for even & odd components of DT signal *x [n]*.
13. State condition for periodicity (CT & DT) and find the fundamental time period of Signal x (t).

$$x(t) = \sin\left(\frac{2\pi}{3}t\right)\cos\left(\frac{4\pi}{5}t\right)$$

14. Determine the energy and power of the signal.

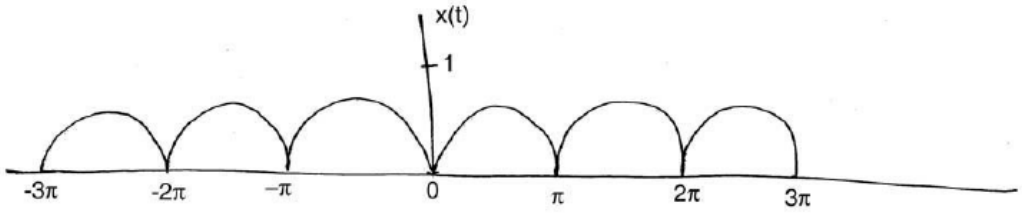
$$x(t) = 14\sin(2\pi t), -\infty < t < \infty$$

15. Explain periodic and non-periodic signals in detail.

a) Obtain the convolution sum of two C.T. sequences given below. Sketch result
h(t) = 4 for $0 \le t \le 2$
= 0 elsewhere
x(t) = 2 for $-2 \le t \le 2$
= 0 elsewhere

b) Find Fourier Transform of
$e^{-2(t-1)}\,u(t-1)$
And solve the convolution and multiplication properties of Fourier Transform.

c) The Complex Fourier coefficient $c_n$ of the full wave rectified sine function shown in figure below is




16. Find y(n) = x(2n) is static or dynamic signal.
17. x(t)= cos(wt), check x(t) is even or odd signal.
18. Determine power of given signal x(t) :

$$x(t) = 10\cos\left(50t + \frac{\pi}{4}\right) + 16\cos\left(100t + \frac{\pi}{3}\right).$$

19. Explain and prove frequency shifting property of discrete time Fourier transform.
20. Which of the following signals are causal or non-causal ?
21. i) $x(t) = e^{-3t}\,u(t)$ ii) $x(t) = u(1-t)$

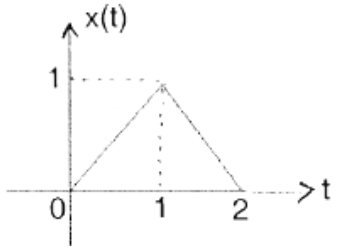
Determine fundamental period of following signals.

i) $x(t) = 2\cos 5t + 6\sin 2t$

ii) $x(n) = \cos(6\pi n) + 3\sin(2\pi n)$

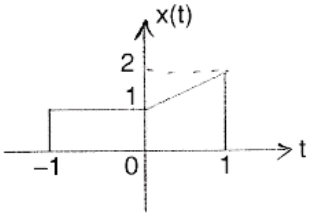
22.

Find even and odd part of given signal.




23.

A) A continuous time signal x(t) is shown below. Sketch the following transformations.




i) x(t – 2) ii) x(1 – t) iii) 3x(t + 1)
iv) x(t/2) v) x(3t).

24.

Determine whether the following signals are energy or power signal. If it is an energy signal, find its energy. If it is a power signal, find its time-averaged power.

$$x(t) = \begin{cases} 5\cos(\pi t), & -1 \le t \le 1 \\ 0 & otherwise \end{cases}$$

25.

Sketch the waveforms of the following signals.

(i) $x(t) = u(t+1) - 2u(t) + u(t-1)$

(ii) $y(t) = r(t+2) - r(t+1) - r(t-1) + r(t-2)$

26.

For each of the following impulse responses, determine whether the corresponding system is memory less, causal and stable.

(i) $h(t) = \cos(\pi t)u(t)$ (ii) $h(t) = e^{-2t}u(t-1)$ (iii) $h[n] = (-1)^n u[-n]$

27.

Determine the homogeneous solution for the systems described by the following equations. (i) $\frac{d^2}{dt^2}y(t) + 6\frac{d}{dt}y(t) + 8y(t) = \frac{d}{dt}x(t)$

(ii) $y[n] + y[n-1] + \frac{1}{4}y[n-2] = x[n] + 2x[n-1]$

28.

Sketch the following signals.

i. $u(t) - u(t-2)$

ii. $r(-0.5t+2)$

29.

Check whether the following signals are periodic. If periodic, find the fundamental time period.

i. $x(t) = 2\cos(10t+1) - \sin(4t-1)$

ii. $x(n) = e^{j\frac{2\pi}{3}n} + e^{j\frac{3\pi}{4}n}$

30.

Determine whether the following signals are energy signals, power signals neither energy nor power signals.

i. $x(t) = e^{-3t}u(t)$

ii. $x(n) = 2e^{j3\pi n}$

iii. $x(t) = t\,u(t)$

31.

Find the response of the system described by the difference equation $y[n] - 1.5y[n-1] + 0.5y[n-2] = \left(\frac{1}{4}\right)^n, for\ n \geq 0$ with initial conditions $y[-1] = 4$ and $y[-2] = 10$.

32.

Determine whether the following systems are time invariant or not if $x(t)$ represents the input and $y(t)$ represents the output.

i. $y(t) = t^2x(t)$

ii. $y(n) = x^2(n-2)$

33.

Determine whether the following signals are causal or not

i. $y(n) = x(n) + \frac{1}{x(n-1)}$

ii. $y(t) = x^2(t) + x(t-2)$

34.

Find even and odd components of the following signals

i. $x(t) = \sin t + 2\sin t + 2\,sin^2 t\cos t$

ii. $x(n) = \{1,0,-1,2,3\}$ where $x(0) = 3$

35.

Check whether or not the given system $y(t) = x(t-2) + x(2-t)$ is linear, time invariant, causal, memory less and stable, where $x(t)$ represents the input and $y(t)$ represents the output.

36.

Find even and odd components of the following signals

i. $x(t) = \cos(t) + \sin(t) + \cos(t)\sin(t)$

ii. $x(n) = \{-2,1,2-1,3\}$, where $x(0) = 2$

37.

Determine the step response of the system described by the difference equation $y[n] - \frac{1}{2}y[n-1] = x[n]$ for $n = 0,1,2,3,4$ where $x[n]$ represents the input and $y[n]$ represents the output. Initial condition $y[-1] = -2$

38.

Find whether the following signals are stable or not if $x(t)$ represents input and $y(t)$ represents output and $h(t)$ represents impulse response.

i. $y(t) = e^{x(t)}$, where $|x(t)| \leq 8$ ii. $h(t) = e^{2t}u(t)$

iii. $y(n) = \delta(n) + \frac{1}{2}\delta(n-1) + \frac{1}{4}\delta(n-2)$ iv. $h(n) = a^n$ for $0 < n < 11$

v. $h(t) = (t+5)u(t)$

40.

Find the convolution between $x(n) = 2^n u(n)$ and $h(n) = \left(\frac{1}{3}\right)^n u(n)$

41.

Check whether the following signals are periodic. If periodic, find the fundamental time period. (i) $x(t) = \cos(60\pi t) + \sin(50\pi t)$ (ii) $x(n) = e^{j\left(\frac{2\pi}{3}\right)n} + e^{j\left(\frac{3\pi}{4}\right)n}$

42.

Determine whether the following signals are energy or power signal. If it is an energy signal, find its energy. If it is a power signal, find its time-averaged power.

$$x(t) = \begin{cases} 5\cos(\pi t), & -1 \leq t \leq 1 \\ 0 & otherwise \end{cases}$$

43.

For each of the following impulse responses, determine whether the corresponding system is memory less, causal and stable.

(i) $h(t) = \cos(\pi t)u(t)$ (ii) $h(t) = e^{-2t}u(t-1)$ (iii)$h[n] = (-1)^n u[-n]$

44.

Determine the homogeneous solution for the systems described by the following equations. (i) $\frac{d^2}{dt^2}y(t) + 6\frac{d}{dt}y(t) + 8y(t) = \frac{d}{dt}x(t)$

(ii) $y[n] + y[n-1] + \frac{1}{4}y[n-2] = x[n] + 2x[n-1]$

45.

Find the discrete time convolution sum of the following signals

(i) $y[n] = \left(\frac{1}{4}\right)^n u[n] * u[n+2]$

(ii) $x(n) = \{2, -1, 1, 3\}$; h(n)={3,4,2}

46.

Check whether the following signals are periodic. If periodic, find the fundamental time period.

i. $x(t) = 2\cos(10t + 1) - \sin(4t - 1)$

ii. $x(n) = e^{j\frac{2\pi}{3}n} + e^{j\frac{3\pi}{4}n}$

47.

Determine whether the following signals are energy signals, power signals, neither energy nor power signals.

i. $x(t) = e^{-3t}u(t)$
ii. $x(n) = 2e^{j3\pi n}$
iii. $x(t) = t\,u(t)$

48.

Find the response of the system described by the difference equation $y[n] - 1.5y[n-1] + 0.5y[n-2] = \left(\frac{1}{4}\right)^n, for\ n \geq 0$ with initial conditions $y[-1] = 4$ and $y[-2] = 10$.

49.

Find the convolution of the signals

$x_1(t) = e^{-2t}u(t)$ and $x_2(t) = e^{-4t}u(t)$

50.

Determine whether the following systems are time invariant or not if $x(t)$ represents the input and $y(t)$ represents the output.

i. $y(t) = t^2 x(t)$

ii. $y(n) = x^2(n-2)$

51.

Determine whether the following signals are causal or not

i. $y(n) = x(n) + \frac{1}{x(n-1)}$

ii. $y(t) = x^2(t) + x(t-2)$

52.

Find even and odd components of the following signals

i. $x(t) = \sin t + 2\sin t + 2\sin^2 t \cos t$

ii. $x(n) = \{1,0,-1,2,3\}$ where $x(0) = 3$

53.

Find even and odd components of the following signals

i. $x(t) = \sin t + 2\sin t + 2\sin^2 t \cos t$

ii. $x(n) = \{1,0,-1,2,3\}$ where $x(0) = 3$

Section-II

UNIT-IV, V & VI

1.

Find Z transform and ROC for the signal $x(n) = \left(\frac{1}{2}\right)^n u(-n)$.

2.

Determine the signal x(n) whose Z-Transform is given by
$X(z) = \log(1 - az^{-1}); |z| > |a|$.

3.

Derive the multiplication by n property of the Z-Transform.

4.

Find 4-point DFT of the following sequence ?
$x(n) = \{1, -2, 3, 4\}$.

5.

Find 8-point IDFT using DIT-FFT Algorithm $X(k) = \{8, 0, 0, 0, 0, 0, 0, 0\}$.

6.

Find 8-point DFT using DIF-FFT of the Sequence $x(n) = \{1, 3, 5, 7, 2, 4, 6, 8\}$.

7.

Determine z Transform, ROC and pole-zero location of X(Z) for

a) $x(n) = \left(\frac{2}{3}\right)^n u(n) + \left(-\frac{1}{2}\right)^n u(n)$

b) $x(n) = a^{|n|}$ ; $|a| < 1$.

.

8. State & prove the linearity property of the CT Fourier transform.

9. State the time shifting property of Z transform & Determine Z transform of

$x[n] = 4u[n + 8]$. Also comment of ROC of the Z transforms

10. Find 4 point DFT of sequence $x[n] = \{2, 4, 3, 9\}$.

11. Find the Fourier transform of $x[n] = 3^n u[n] - 4^n [n+ 3]$

12. State & prove the periodicity property of Discrete Time Fourier Transform.

13. Find 8 point DFT of sequence $x[n] = \{1, 3, 5, 7, 2, 4, 6, 8\}$ by using DITFFT algorithm.

14. Find 8 point DFT of given signal $x[n]$ by using DIF-FFT algorithm.

$$x[n] = \begin{cases} n + 2 & 0 \le n \le 3 \\ n - 2 & 4 \le n \le 7 \end{cases}$$

15.

Find inverse Z transform of $X(Z) = \frac{z+2}{z^2+3z-1}$ using power series expansion method if

1) $x[n]$ is casual
2) $x[n]$ is non-casual

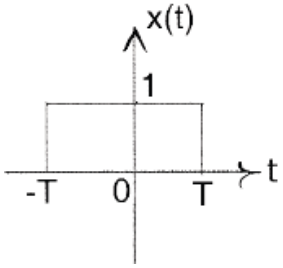
16.

1) Find z-transform of signal $x(n) = (0.5)^n u(n)$.
2) Find DFT of the signal x(n) = (1 2 3 4).

17.

Find Fourier transform of unit step function.

Find fourier transform of signal shown below.




18.

Find inverse z-transform of

$$X(z) = \frac{1+2z^{-1}}{1-2z^{-1}+z^{-2}} \text{ for x(n) is}$$

i) Causal
ii) Anticausal using power series method.

19.

Find inverse z-transform of

$$X(z) = \frac{1+2z+3z^2}{2+3z+z^2}$$

using partial fraction expansion method.

20.State and prove Parseval's theorem for continuous time Fourier series

21.

Compute the DTFS coefficients of the following signals

(i) $x[n] = \cos(\frac{6\pi}{17}n + \frac{\pi}{3})$ (ii) $x[n] = 2\sin(\frac{14\pi}{19}n) + \cos(\frac{10\pi}{19}n) + 1$

22.

Find the DTFT of $x(n) = (0.5)^n u(n) + 2^{-n}u(-n-1)$.

23.

Find the time domain signal associated with FS coefficients $X(k) = \left(\frac{-1}{3}\right)^{|k|}$; $\omega_0 = 1\, rad/sec$

24. State and prove time shifting property of CTFT.

25.

Find Fourier transform of $x(t) = e^{-3t}[u(t+2) - u(t-3)]$.

26.

Determine the Nyquist sampling rate and Nyquist sampling interval for the signal $x(t) = \sin c(200\pi t) + 3 \sin c^2(120\pi t)$.

27

Using z-transform find the convolution of two sequences

$x_1 = \{1, 2, -1, 0, 3\}$; $x_2 = \{1, 2, -1\}$.

28. Explain what is convolution in frequency domain.

29. Explain and prove frequency shifting property of discrete time Fourier transform.

27.

A causal and stable LTI system has the property that $\left(\frac{4}{5}\right)^n u(n) \rightarrow n\left(\frac{4}{5}\right)^n u(n)$.

a) Determine the frequency response $H(e^{j\omega})$ for the system.

b) Find Fourier series for the periodic signal $x(t) = t$ $0 \le t \le 1$ and repeats at every 1 sec.

.

28.

Find the Z Transform of the following signals

(i) $x[n] = \sin\Omega_0 n\, u[n]$ (ii) $x[n] = na^n u[n]$

29.

An LTI system has impulse response $h(n) = \left(\frac{1}{2}\right)^n u(n)$. Determine the input $x(n)$ to the system if the output is given by $y(n) = \left(\frac{1}{2}\right)^n u(n) + \left(\frac{-1}{2}\right)^n u(n)$

30.

If $Z$ transform of $x[n]$ is $X[Z]$, prove that the $Z$ transform of $nx[n]$ is $-z\frac{d}{dz}X[Z]$

31.

Determine whether each of the following LTI system is

i. $H[Z] = \frac{1+2z^{-1}}{1+\frac{14}{8}z^{-1}+\frac{49}{64}z^{-2}}$

ii. $y[n] - \frac{6}{5}y[n-1] - \frac{16}{25}y[n-2] = 2x[n] + x[n-1]$

a) Determine whether the systems described by these functions can be both stable and causal?

32. Write a short note on how causality and stability of an LTI system are characterized by Laplace transform of its impulse response.

33.

b) Find the Z-transform, ROC and pole–zero location of the following signals.

(i) $x(n) = a^{|n|};\ |a| < 1$ (ii) $\left(\frac{1}{2}\right)^n u[n] + \left(\frac{-1}{3}\right)^n u[n]$

34.

(i) Find the Z-transform of the following signal

$$x[n] = \left(1/2\right)^n u[n] * 2^n u[-n-1]$$

(ii) Find the time domain signal corresponding to the Z transform.

$$X(z) = \frac{1 + \frac{7}{6}z^{-1}}{(1 - \frac{1}{2}z^{-1})(1 + \frac{1}{3}z^{-1})}\ , |z| > \frac{1}{2}$$

35.

Find the inverse Z-transform of

$$X(z) = \frac{1+\frac{7}{6}z^{-1}}{(1-\frac{1}{2}z^{-1})(1+\frac{1}{3}z^{-1})}\ \text{, with ROC}\quad 1/3 < |z| < 1/2$$

36.

Using Fourier Transform, find the convolution of the signals $x_1(t) = te^{-t}u(t)$ and $x_2(t) = te^{-2t}u(t)$

37.

One period of the DTFS coefficients of a signal is given by $X[k] = \left(\frac{1}{2}\right)^k$ for $0 \leq k \leq 9$. Find the time domain signal $x(n)$ by assuming $N = 10$.

38.

Determine the $z$ transform and Region of Convergence (ROC) of the signal $x(n) = a^n u(n) - b^n u(-n-1)$

39.

Determine the unit step response for the causal LTI system described by the difference equation using Z-Transform.

$$y[n] = 7y[n-1] - 12y[n-2] + 2x[n] - x[n-2]$$

40.

Find the DTFS representation for $x[n] = \cos\left(\frac{\pi}{8}n + \emptyset\right)$

41.
Determine the DTFT representation to determine the time domain signal of $X(e^{j\Omega}) = e^{-j\Omega}$ $for$ $-\pi \leq \Omega \leq \pi$

42.
Use the defining equation for Fourier transform, to evaluate the frequency domain representations of $x(t) = e^{-4|t|}$. Sketch the magnitude and phase spectra.

43.
Find the Z-transform of the signal $x(n) = [sin\omega_0 n]u(n)$ and find ROC

Find the inverse z-transform of $X(z) = \frac{1-z^{-1}+z^{-2}}{(1-\frac{1}{2}z^{-1})(1-2z^{-1})(1-z^{-1})}; ROC\ 1 < |z| < 2$

44. Explain the properties of Region of Convergence of X(z).

45. Write short notes on differential and difference equation representation of LTI systems.

46.
Compute the Fourier transform of the signal

$$x(t) = \begin{cases} 1 + \cos \pi t, & |t| < 1 \\ 0, & |t| > 1 \end{cases}$$

47.
Consider a causal LTI system with impulse response $h(t) = e^{-4t}u(t)$. Find the output of the system for an input $x(t) = 3e^{-t}u(t)$ using Fourier transform.

48.
Compute the DTFS coefficients of the following signals

(i) $x[n] = \cos(\frac{6\pi}{17}n + \frac{\pi}{3})$ (ii) $x[n] = 2\sin(\frac{14\pi}{19}n) + \cos(\frac{10\pi}{19}n) + 1$

49.
Find the DTFT of $x(n) = (0.5)^n u(n) + 2^{-n}u(-n-1)$.

50.