

PART A
General Engineering
(CIVIL AND STRUCTURAL)

- ✓ 1. (a) What are the constituents of good brick-earth ? What constituents render brick-earth unsuitable for manufacturing bricks? 10
- (b) Describe any two tests to be performed in case of burnt clay bricks. 10
- (c) State the conditions under which you will recommend the following cements. Give also the reasons.
- (i) Rapid hardening cement
- (ii) High Alumina cement 10
- (d) Briefly explain 10
- (i) Assessed value
- (ii) Sinking fund
- (e) Determine the number of bags of cement required for a standard brick masonry for a wall of thickness 30 cm for a height of 10 m and length 200 m in 1 : 4 mortar. 20
- ✓ 2. (a) The readings given in the Table below were recorded in a levelling operation from points 1 to 10. Reduce the levels by the height of instrument method and apply appropriate checks. The point 10 is a bench mark having elevation of 66.374 m. Determine the loop closure. 30

Station	Chainage (m)	B.S.	I.S.	F.S.	Remarks
1	0	0.597			B.M. = 68.233 m
2	20	2.587		3.132	C.P
3	40		1.565		
4	60		1.911		
5	80		0.376		
6	100	2.244		1.522	C.P
7	120		3.771		
8	140	1.334		1.985	C.P
9	160		0.601		
10	180			2.002	

- (b) A soil sample in its natural state has, when fully saturated, a water content of 32.5%. Determine the void ratio, dry and total unit weights. Calculate the total weight of water required to saturate a soil mass of volume 10 m^3 . Assume $G_s = 2.69$. 15
- (c) Describe the method of laying Water Bound Macadam (WBM) road. 15
3. (a) Find the discharge through a rectangular orifice 2.0 m wide and 1.5 m deep fitted to a water tank. The water level in the tank is 3.0 m above the top edge of the orifice. Take $c_d = 0.62$. 30
- (b) Enumerate the assumptions made in Lacy's theory of canal designs. 15
- (c) Write short note on types of impurities in water in the light of domestic supply. 15
4. (a) Draw the shear force and bending moment diagram and label the values of the largest positive and negative shearing forces and bending moments for the beams with overhang as shown in Figure 1. 30

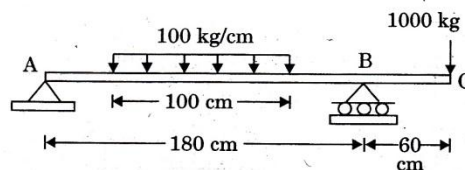


Figure 1

- (b) Describe the various defects in concrete along with precautions that should be exercised to prevent them. 30
5. (a) Describe briefly creep and shrinkage. 20
- (b) A rectangular, singly reinforced beam 300 mm wide and 500 mm effective depth is used as a simply supported beam over an effective span of 6 m. The reinforcement consists of 4 bars of 20 mm dia. If the beam carries a load of 12 kN/m (inclusive of self weight), determine the stress developed in concrete and steel. Take $m = 19$. 40
6. (a) Classify welded joints according to type of joints. 20
- (b) A single rivet lap joint is used to connect 12 mm thick plates by providing 20 mm dia rivets at 50 mm pitch. Determine the strength of the joint and joint efficiency. Take working stress in shear in rivets = 80 N/mm^2 , working stress in bearing in rivets = 250 N/mm^2 and working stress in axial tension in plates = 156 N/mm^2 . 40

PART B
General Engineering
(ELECTRICAL)

1. (a) A copper wire has a resistance of 0.85Ω at 20°C . What will be its resistance at 40°C ? Temperature coefficient of resistance of copper at 0°C is 0.004°C . 10
- (b) In the circuit shown in Figure 1, what is the value of V ? 10

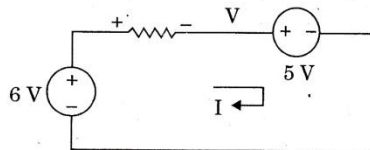


Figure 1

- (c) What is the value of Thevenin voltage E_{Th} in the given circuit of Figure 2? 10

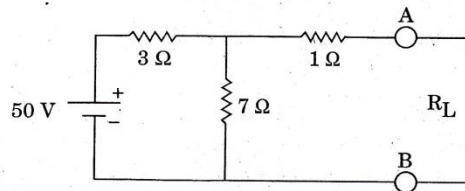


Figure 2

- (d) In Figure 3, find the value of resistance R . 30

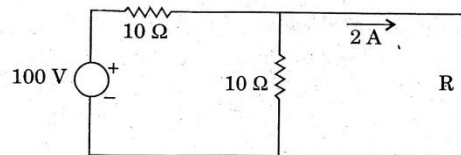


Figure 3

2. (a) Define the following terms : 5+5+5+5=20
- (i) Magnetic field intensity
 - (ii) Magnetic flux density
 - (iii) Magnetomotive force
 - (iv) Reluctance
- (b) In a pair of coupled coils, coil 1 has a continuous current of 2 A and the corresponding fluxes ϕ_{11} and ϕ_{21} are 0.3 and 0.6 mWb respectively. If the turns are $N_1 = 500$ and $N_2 = 500$, find L_1 , L_2 , M , and K . 10
- (c) An AC voltage of 50 Hz has a maximum value of 50 V. What will be its voltage after 1/600 second ? 10
- (d) A circuit with a resistor, inductor, and capacitor in series is resonant of f_0 Hz. If all the component values are now doubled, find the new resonant frequency. 20
3. (a) A 100 μ A ammeter has internal resistance of 100 Ω . For extending its range to measure 500 μ A, calculate the value of shunt resistance (in Ω). 10
- (b) A wattmeter is connected as shown in Figure 4. What will be the wattmeter reading of power consumed either by Z_1 or Z_2 ? 10

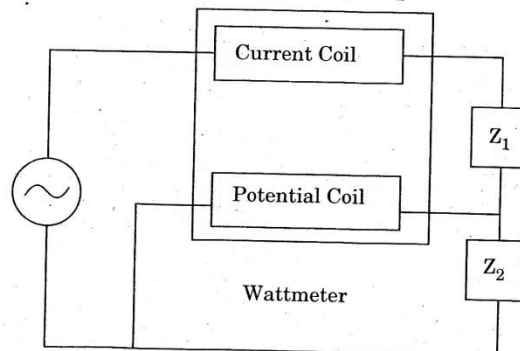


Figure 4

- (c) A CRO screen has ten divisions on the horizontal scale. If a voltage signal $5 \sin(314t + 45^\circ)$ is examined with a line base setting of 5 msec/div, find the number of cycles of signal displayed on the screen. 20
- (d) Prove that the power in AC circuit is equal to $VI \cos \phi$. 20

4. (a) Explain the various losses in DC machines. 20
- (b) A DC machine induces an EMF of 240 V at 1500 rpm. Find the developed torque for an armature current of 25 A. 10
- (c) A 3300/300 V single phase transformer gives 0.6 A and 60 W as ammeter and wattmeter readings when supply is given to the low voltage winding and high voltage winding is kept open. What is the power factor of no load current? 15
- (d) A 3 hp, 3-phase, 4-pole, 400 V, 50 Hz induction motor runs at 1440 rpm. What will be the frequency of the rotor-induced EMF? 15
5. (a) Explain the need for connecting a capacitor in the auxiliary winding of a single phase induction motor. 15
- (b) Why are two alternators connected in parallel to supply a common load? What are the necessary conditions for parallel connection? 15
- (c) What are the advantages and disadvantages of AC over DC? 15
- (d) Overhead power transmission lines are preferred over underground power cables. Discuss. 8
- (e) What are the main advantages of SF6 circuit breakers? 7
6. (a) A residential flat has the following average electrical consumptions per day :
- (i) 4 tube lights of 40 watts working for 5 hours per day;
 - (ii) 2 filaments of 60 watts working for 8 hours per day;
 - (iii) 1 water heater rated 2 kW working for 1 hour per day;
 - (iv) 1 water pump of 0.5 kW rating working for 3 hours per day.
- Calculate the cost of energy per month if 1 kWh of energy (i.e., 1 unit of energy) costs ₹ 3.50. 20
- (b) Cite the advantages and disadvantages of electric drives. 20
- (c) A silicon diode is connected across a 3 V supply with a series resistance of $20\ \Omega$ as shown in Figure 5. Neglecting diode resistance, find the diode current. 20

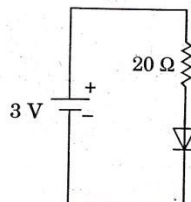


Figure 5

PART C
General Engineering
(MECHANICAL)

1. (a) Differentiate between single point and multipoint cutting tool. 15
- (b) Find the speed of a shaft which is driven with the help of a belt by an engine running at 300 rpm. The diameter of the engine pulley is 60 cm and that of the shaft is 40 cm. 15
- (c) Explain the role of cutting fluid in machining. 15
- (d) Explain the following terms : 15
- (i) Module
 - (ii) Pressure angle
 - (iii) Addendum

2. (a) Define the following terms : 15
- (i) Angle of friction
 - (ii) Coefficient of friction
 - (iii) Angle of repose
 - (iv) Poisson's ratio
 - (v) Elastic limit

- (b) A cantilever beam of 8 m length is subjected to point loads of 10 kN, 15 kN, 25 kN, and 20 kN at distances of 2 m, 4 m, 6 m and 8 m respectively from the fixed end as shown in Figure 1. Draw the shear force diagram and bending moment diagram. 15

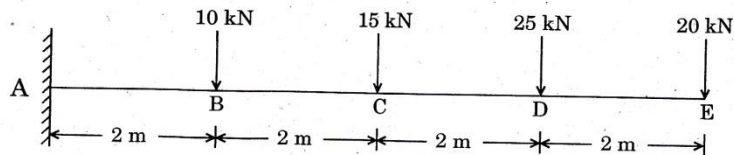


Figure 1

- (c) Find the lowest speed at which 250 kW could be transmitted through a shaft of diameter 63 mm. The maximum shear stress is limited to 50 MPa. If length of the shaft is 6 m, find the angle of twist. Take $G = 80 \text{ GPa}$. 15
- (d) In separate experiments, Young's Modulus and Modulus of Rigidity of a material have been determined as 120 GPa and 50 GPa respectively. Calculate the Poisson's Ratio and Bulk Modulus of the material. 15

3. (a) Compare the working principle of 4-stroke and 2-stroke cycles of internal combustion engines. 15
- (b) State and explain the Clausius statement of the second law of thermodynamics. 15
- (c) A mixture of gases expands at constant pressure from 1 MPa, 0.03 m^3 to 0.06 m^3 with 90 kJ heat transfer to the system. There is no work other than 'work done' on a piston. Find the change in internal energy of the mixture. 15
- (d) The properties of a certain fluid are related as follows : 15
- $$u = 196 + 0.718 t$$
- $$pv = 0.287 (t + 273)$$
- where u is the specific internal energy (kJ/kg), t is in $^{\circ}\text{C}$, p is pressure (kN/m^2), and v is specific volume (m^3/kg). For this fluid, find C_u and C_p .
4. (a) A tank contains a liquid of specific gravity 0.80. Find the absolute pressure and gauge pressure at a point which is 2 m below the free surface of the liquid. The atmospheric pressure head is equivalent to 760 mm of mercury. 15
- (b) Define the following and give one practical example of each : 15
- (i) Laminar flow
 - (ii) Turbulent flow
 - (iii) Steady flow
 - (iv) Uniform flow
 - (v) Unsteady flow
- (c) What is a centrifugal pump ? Explain the working of a single-stage centrifugal pump with sketches. 15
- (d) Derive the expression : 15
- $$C_d = C_v \times C_c$$
- where C_d = co-efficient of discharge
 C_v = co-efficient of velocity
 C_c = co-efficient of contraction
5. (a) What is the difference between soldering and brazing ? 15
- (b) Describe with the help of neat sketches, TIG welding and MIG welding 15
- (c) What are the common defects of casting ? State their causes and remedies. 15
- (d) What are the advantages of centreless grinding ? 15
6. (a) Explain the various safety precautions associated with lathe. 15
- (b) Define tool life and name the variables which affect tool life. 15
- (c) What is a siphon ? Where is it used ? Explain its working principle. 15
- (d) Sketch a schematic diagram of a steam power plant and explain the various processes of Rankine cycle on T-S or p-v diagram. 15