

# CBCS SCHEME

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15ME51

## Fifth Semester B.E. Degree Examination, Aug./Sept.2020 Management and Engineering Economics

Time: 3 hrs.

Max. Marks: 80

*Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.  
2. Use of Interest table is permitted.*

### Module-1

- 1 a. Define Management. Explain functional areas of management. (08 Marks)  
b. Describe briefly role of Management. (08 Marks)

OR

- 2 a. Define planning and explain nature of planning. (08 Marks)  
b. Describe steps in planning and planning premises. (08 Marks)

### Module-2

- 3 a. List the different types of organizations and explain briefly Functional organization, Line and Staff organization. (08 Marks)  
b. Describe briefly processes of selection for recruitment. (08 Marks)

OR

- 4 a. List and explain different leadership styles. (08 Marks)  
b. Describe briefly steps in controlling process. (08 Marks)

### Module-3

- 5 a. Explain Problem Solving and Decision Making. (05 Marks)  
b. Explain law of returns. (05 Marks)  
c. A product has a demand of 3000 units when priced at Rs.100/unit. When the price is reduced at Rs.80/unit the sales increases to 3800 units.  
(i) Find whether the demand is elastic or inelastic.  
(ii) At what quantity of sales can the demand be called elastic or inelastic? (06 Marks)

OR

- 6 a. A person takes a loan of Rs.10,000 from a bank of interest of 10% P.A. Find the amount if  
(i) Interest is compounded annually  
(ii) Interest is compounded half yearly  
(iii) Interest is compounded quantity  
(iv) Interest is compounded monthly. (08 Marks)  
b. Explain cash flow diagram lender point of view and borrow point of view. (04 Marks)  
c. If a person deposited Rs. 25000 into a saving account that earn 12% per year, what uniform annual amount could be withdrawn at the end of each year for 10 years. (04 Marks)

**Module-4**

- 7 a. Explain briefly conditions for present worth comparison (06 Marks)  
 b. Company is evaluating three robots for possible use in its assembly operating data associated with robots are as follow:

Particulars	Robot A	Robot B	Robot C
First Costs (Rs.)	55000	58000	53000
Operating and maintenance costs (Rs.)	3000/year	4500/year	4000/year
Expected incomes (Rs.)	44000/year	44000/year	38000/year
Expected salvage value (Rs.)	4000	6000	4000

All values in rupees. Assuming a technological life of 3 years and a desired interest rate of 12% which robot seems to be preferable assuming all other factors are equal? Use net present worth evaluation. (10 Marks)

**OR**

- 8 a. A plot can be purchased for Rs. 13,80,000 company A offers a loan at 7.5% nominal interest to be compounded monthly. If a down payment of Rs. 25,000 is paid initially. The loan is to be paid off in 15 years. Company B offers 20 years repayment period with the same down payment but the nominal interest rate is 9% compounded monthly. Evaluate the monthly payment for the above two alternatives. (10 Marks)  
 b. Briefly explain Minimum Acceptable Rate of Return (MARR), IRR, ERR. (06 Marks)

**Module-5**

- 9 a. Explain how selling price of components / Products are fixed. (06 Marks)  
 b. A small firm is producing 100 pens per day. The direct material cost is found to be Rs. 160. Direct labour cost Rs. 200 and factory overheads chargeable to it Rs. 250. If the selling on cost is 40% of the factory cost. What must be the selling price of each pen to realize a profit of 14.6% of the selling price. (05 Marks)  
 c. An article can be made either by hand or in large quantity by mass production. If the former case, time taken is 3 hrs and overheads are 25% of labour cost, while in the later case time takes for 10 pieces is 8 hours but overheads are 150% of labour cost. Material cost is Rs. 1.50/piece and labour charges are Rs.0.80/hr. Compare the total cost in both the cases. (05 Marks)

**OR**

- 10 a. What is depreciation explain the causes of depreciation. (06 Marks)  
 b. A lathe is purchased for Rs.8,00,000 and assumed life is 10 years and scrap value is Rs.2,00,000. If the depreciation is charged by (i) Diminishing balance method – Depreciation fund after 2 years. (ii) Straight line method of depreciation (iii) SOYD method – for 4 years. (10 Marks)

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## Fifth Semester B.E. Degree Examination, Aug./Sept. 2020 Dynamics of Machinery

Time: 3 hrs.

Max. Marks: 80

**Note:** Answer any FIVE full questions, choosing ONE full question from each module.

### Module-1

- 1 a. State the conditions for static equilibrium of a body subjected to a system of, (i) two forces (ii) Three forces. (04 Marks)
- b. For the static equilibrium of the quick return mechanism shown in Fig. Q1 (b). Find the required input torque  $T_2$  for a force of 3500 N on the slider. Angle of EB with the vertical is  $70^\circ$ . The impending motion of the slider is to the lift. (12 Marks)

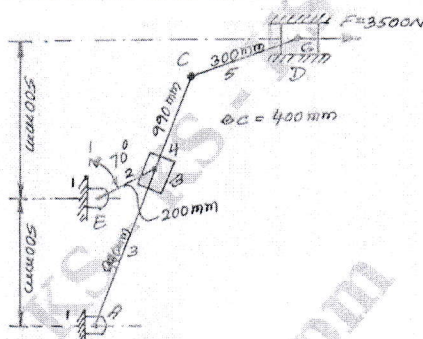


Fig. Q1 (b)

OR

- 2 a. What do you mean by inertia force and inertia torque? (04 Marks)
- b. A four bar mechanism shown in Fig. Q2 (b) has the following length of various links  $O_2O_4 = 800$  mm,  $O_2B = 330$  mm,  $BC = 500$  mm,  $O_4C = 400$  mm,  $O_2G_2 = 200$  mm,  $BG_3 = 250$  mm,  $O_4G_4 = 200$  mm. The masses of links are  $m_2 = 2.2$  kg,  $m_3 = 2.5$  kg,  $m_4 = 2$  kg. The moment of inertia of links about their C.G are  $I_2 = 0.05$  kg-m<sup>2</sup>,  $I_3 = 0.07$  kg-m<sup>2</sup>. The crank  $O_2B$  rotates at  $100$  rad/s<sup>2</sup>. Neglecting gravity effects, determine the forces in the joints and the input torque. (12 Marks)

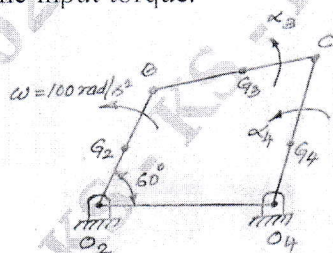


Fig. Q2 (b)

### Module-2

- 3 a. What do you mean by static balancing and dynamic balancing? (04 Marks)
- b. A rotating shaft carries 4 masses A, B, C and D at radii 100, 125, 200 & 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the masses B, C and D having 10, 5 and 4 kg respectively. Find the required mass A and relative angular positions of 4 masses to keep the shaft in balance. (12 Marks)

OR

- 4 The cranks and connecting rods of a 4-cylinder in line engine running at 1800 rpm are 60 mm and 240 mm. Each respectively and the cylinder are spaced 150 mm apart. If the cylinders are numbered 1 to 4 in sequence from one end, the cranks appear at intervals of  $90^\circ$  in an End view in the order 1 – 4 – 2 – 3. The reciprocating mass corresponding to each cylinder is 1.5 kg. Determine
- Unbalanced primary and secondary force.
  - Unbalanced primary and secondary couples with reference to control plane of the engine.
- (16 Marks)**

Module-3

- 5 a. Define the following: (i) Sensitiveness (ii) Hunting (iii) Isochronism  
(iv) Effort of governor (v) Stability of governor  
(vi) Power of governor. **(06 Marks)**
- b. A loaded governor of the porter type has equal arms and links each 300 mm long. The weights of each ball is 20 N and the central weight is 120 N. When the ball radius is 150 mm, the valve is fully open and when the radius is 180 mm, the valve is closed. Find the maximum speed and the range of speed. If the maximum speed is to be increased 25% by an addition of weight to the central load, find its value. **(10 Marks)**

OR

- 6 a. Derive an expression for the gyroscopic couple  $C = I\omega\omega_p$  from first principle. **(06 Marks)**
- b. A four wheeled trolley car has a total mass of 3000 kg. Each axle with its two wheels and gears has a total M.I. of  $32 \text{ kg-m}^2$ . Each wheel is of 450 mm radius. The centric distance between two wheel is 1.4 m. Each axle is driven by a motor with speed ratio of 1 : 3. Each motor along with its gear has a M.I of  $16 \text{ kg-m}^2$  and rotates in the opposite direction to that of axle. The centre of mass of the car is 1 m above the rails. Calculate the limiting speed of the car when it has to travel around curve of 250 m radius without the wheels leaving the rails. **(10 Marks)**

Module-4

- 7 a. Define vibration. Give the classification of vibration. **(05 Marks)**
- b. Add the following harmonic motions and check the solution graphically  
 $x_1 = 2 \cos(\omega t + 0.5)$ ,  $x_2 = 5 \sin(\omega t + 1.0)$ . **(11 Marks)**

OR

- 8 a. Determine the natural frequency of the spring mass system considering mass of the spring. **(08 Marks)**
- b. Find the natural frequency of the system as shown in Fig. Q8 (b). Solve by energy method. **(08 Marks)**

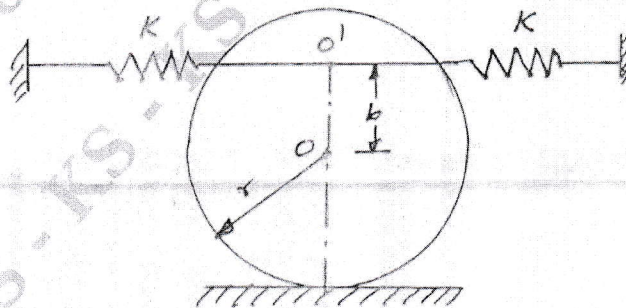


Fig. Q8 (b)



Module-5

- 9 a. Define damping. Explain different types of damping with neat sketches. (10 Marks)
- b. Show that the ratio of successive amplitudes of mass in a under damped, viscously damped spring mass system is given by  $\frac{x_0}{x_1} = e^{\delta}$  where  $\delta = \frac{2\pi\xi}{\sqrt{1-\xi^2}}$ . (06 Marks)

OR

- 10 a. Write a note on vibration isolation and transmissibility. Explain the influence of frequency ratio on transmissibility. (08 Marks)
- b. A weight of 60 N suspended by a spring of stiffness 1.2 kN/m is forced to vibrate by a harmonic force of 10 N. Assuming viscous damping of 0.086 kN-s/m. Determine
- The resonant frequency.
  - Amplitude at resonance.
  - Phase angle at resonance.
  - Frequency corresponding to peak amplitude.
  - Peak amplitude.
- (08 Marks)

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15ME53

## Fifth Semester B.E. Degree Examination, Aug./Sept.2020 Turbo Machines

Time: 3 hrs.

Max. Marks: 80

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

### Module-1

- 1 a. Define Turbomachine. With a neat sketch, explain the parts of Turbomachine. (04 Marks)
- b. Define specific speed of a pump. Obtain an expression for the same in terms of Discharge, Speed and head. (06 Marks)
- c. Test on a Turbine Runner 1.25m in diameter at 30m head gives the following result, power developed 736kW, speed 180rpm, Discharge 2.7m/s. Find the Diameter, Speed and Discharge of a Runner to operate at 45m head and gives 1472kW power at same efficiency. (06 Marks)

OR

- 2 a. Derive an expression for polytropic efficiency of a compression process Interms of pressure and temperature ratio. (06 Marks)
- b. A 16 stage Axial flow compressor is to have a pressure ratio of 6.3 and test have shown that a stage efficiency of 89.5% can be obtained. The Intake conditions are 288°K, 1 bar. Find:
  - i) Overall Efficiency
  - ii) Polytropic Efficiency
  - iii) Preheat factor. (06 Marks)
- c. Explain static and stagnation state for a fluid. (04 Marks)

### Module-2

- 3 a. Derive the alternate form of Euler's Turbine equation and state the significance of each components. (08 Marks)
- b. As inward flow radial Vane Turbine has the following data: Power = 150kW, Speed = 32000rpm, Outer diameter of the Impeller = 20cm, Inner diameter of the Impeller = 8cm. Absolute velocity of gas at entry = 387m/s. Absolute velocity of gas at Exit = 193m/s and is Radial in direction, construct the velocity triangle at entry and exit of the Impeller and Determine:
  - i) Mass flow rate
  - ii) Percentage energy transfer due to change of radius. (08 Marks)

OR

- 4 a. The total power Input at a stage in an axial flow compressor with symmetric inlet and outlet velocity triangle ( $R = 0.5$ ) is 27.85kJ/kg of air flow. If the blade speed is 180m/s throughout the Rotor, Draw the velocity triangle and compute the inlet and outlet rotor blade angles. Assume axial velocity component to be 120m/s. (08 Marks)
- b. The mean Rotor blade speed of an Axial flow turbine stage with 50% reaction is 210m/s. Steam emerges from the Nozzle inclined at 28° to the plane of the wheel with Axial component equal to blade speed. Assuming symmetric inlet and outlet velocity triangles. Determine the Rotor blade angle and utilization factor. Also determine the degree of reaction to make the utilization maximum if the axial velocity, blade speed as well as nozzle angle remain the same. (08 Marks)



**Module-3**

- 5 a. Define: i) Blade efficiency ii) Nozzle efficiency iii) Stage efficiency for impulse steam turbine. (06 Marks)
- b. Derive an expression for condition for maximum efficiency of a reaction steam turbine. (10 Marks)

OR

- 6 a. In a 50% Reaction Turbine the blade speed is 65m/s dry steam at 1.5bar flows at 5kg/s the blade angles are  $20^\circ$  and  $35^\circ$ . Find: i) Blade height which is 1/10 diameter of the blade ring ii) Power developed iii) Heat drop if stage efficiency is 80%. (08 Marks)
- b. In a Parsons Turbine the axial velocity of flow of steam is 0.5 times the mean blade speed. The outlet angle of the blade is  $20^\circ$ , the diameter of the blade ring is 1.3m and the Rotational speed is 3000rpm. Determine inlet blade angles, power developed for the steam flow of 65kg/s and the Isentropic Enthalpy drop if the stage efficiency is 80%. (08 Marks)

**Module-4**

- 7 a. Classify Hydraulic turbines with examples. (04 Marks)
- b. With a neat sketch, explain Pelton Wheel Turbine. (05 Marks)
- c. A Pelton Wheel is to be designed for the following specifications. Shaft power = 735kW, head = 200m, speed = 600rpm, overall efficiency = 0.75, the jet diameter not to exceed 1/10<sup>th</sup> of the wheel diameter,  $C_v = 0.958$ , speed ratio = 0.5. Determine: i) Wheel diameter ii) Number of Jets required iii) Diameter of Jet. (07 Marks)

OR

- 8 a. A Kaplan Turbine has an outer diameter of 8m and inner diameter as 3m and developing 30.000kW at 80rpm under a head of 12m. The discharge through the runner is  $300\text{m}^3/\text{sec}$  if Hydraulic Efficiency is 95%. Determine Inlet and Outlet blade angles, Mechanical Efficiency, Overall Efficiency. (08 Marks)
- b. A Francis Turbine has wheel diameter of 1m at the entrance and 0.5m at the exit. The guide vane angle is  $15^\circ$ . The water at exit leaves the vane without any Tangential component. The vane angle at the entrance is  $90^\circ$ . The head is 30m and the radial component of the flow is constant. What would be the speed of the wheel in rpm and vane angle at exit? (08 Marks)

**Module-5**

- 9 a. What is meant by cavitation in centrifugal pumps? What are the causes of cavitation? (08 Marks)
- b. The outer diameter of the Impeller of a centrifugal pump is 40cm and width of the impeller at outlet is 5cm. The pump is Running at 800rpm and working against a total head of 15m. The vane angle at outlet is  $40^\circ$  and Manometric efficiency is 75%. Determine: i) Velocity of flow at outlet ii) Velocity of water leaving the vane iii) Angle made by the absolute velocity at outlet iv) Discharge. (08 Marks)

OR

- 10 a. Define the following terms of centrifugal compressor:  
i) Overall pressure ratio ii) Pressure co-efficient iii) Slip factor iv) Power factor. (08 Marks)
- b. An Axial flow compressor with 50%. Reaction is having a flow coefficient with 0.54. Air enters the compressor at stagnation condition of 1 bar and  $30^\circ\text{C}$ . The total-to-total efficiency across the rotor is 0.88 pressure coefficient is 0.45 and the workdone factor is 0.88. The Total-to-total pressure ratio across the rotor is 1.26. Mass flow rate is 15kg/sec. Calculate:  
i) Mean rotor blade speed ii) Rotor angles at inlet and exit iii) Power Input to the system (08 Marks)

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15ME54

## Fifth Semester B.E. Degree Examination, Aug./Sept.2020 Design of Machine Elements – I

Time: 3 hrs.

Max. Marks: 80

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.  
2. Use of Design Data handbook is permitted.*

### Module-1

- Draw the stress strain diagram for a ductile material and briefly explain the salient points. (06 Marks)
  - What are the factors to be considered for the selection of material for a machine component? (06 Marks)
  - Explain the codes and standards used in machine design. (04 Marks)

OR

- Define stress concentration. Briefly explain the factors effecting stress concentration. (06 Marks)
  - A round rod of diameter  $1.2d$  has semicircular groove of diameter  $0.2d$ . The rod is subjected to a bending moment of  $10 \text{ kN-m}$ . The material of the rod is C30 steel ( $\sigma_y = 294 \text{ N/mm}^2$ ). Determine the safe value of 'd'. If the factor of safety = 2. (10 Marks)

### Module-2

- Derive an expression for instantaneous stress due to axial impact. (06 Marks)
  - A cantilever beam of width  $50 \text{ mm}$ , depth  $150 \text{ mm}$  is  $1.5 \text{ m}$  long. It is struck by a weight of  $1000 \text{ N}$  that falls from a height of  $10 \text{ mm}$  at its free end. Determine impact factor, instantaneous maximum deflection, instantaneous maximum stress, instantaneous maximum load. Take  $E = 206 \text{ GPa}$ . (10 Marks)

OR

- A steel cantilever member shown in Fig.Q4 is subjected to a transverse load at its end that varies from  $45 \text{ N}$  (up) to  $135 \text{ N}$  (down) and axial load varies from  $110 \text{ N}$  (compression) to  $450 \text{ N}$  (tension). Determine the required diameter at the change of section for infinite life using a factor of safety 2. The strength properties of the material are  $\sigma_u = 550 \text{ MPa}$ ,  $\sigma_y = 470 \text{ MPa}$ ,  $\sigma_{-1} = 275 \text{ MPa}$ , notch sensitivity index,  $q = 1$ .

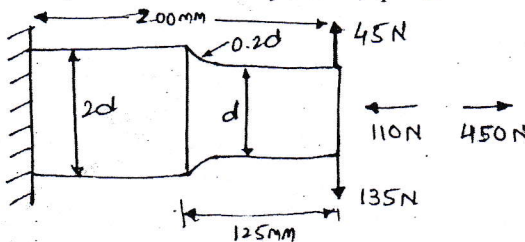


Fig.Q4

(16 Marks)

### Module-3

- A mild steel shaft transmits  $20 \text{ kW}$  at  $200 \text{ rpm}$ . It carries a central load of  $900 \text{ N}$  and is simply supported between the bearings  $2.5 \text{ m}$  apart. Determine the size of the shaft, if the allowable shear stress is  $42 \text{ MPa}$  and the maximum tensile or compressive stress is not to exceed  $56 \text{ MPa}$ . What size of the shaft will be required, if it is subjected to gradually applied loads? (16 Marks)



OR

- 6 a. Design a knuckle joint to connect two circular rods subjected to an axial tensile force of 50 kN. The rods are co-axial and a small amount of angular movement between their axes is permissible. The design stresses may be taken as  $80 \text{ N/mm}^2$  in tension,  $40 \text{ N/mm}^2$  in shear and  $80 \text{ N/mm}^2$  in compression. (08 Marks)
- b. Design a flange coupling to connect the shaft of a motor and centrifugal pump for the following specifications: pump output = 3000 liters/minute, total head = 20 m, pump speed = 600 rpm, pump efficiency = 70%. Select C40 steel ( $\sigma_y = 328.6 \text{ MPa}$ ) for shaft and C35 steel ( $\sigma_y = 304 \text{ MPa}$ ) for bolts with factor of safety 2. Use allowable shear stress in cast iron flanges equal to  $15 \text{ N/mm}^2$ . (08 Marks)

Module-4

- 7 a. Briefly explain the types of failure in riveted joints. (04 Marks)
- b. Design a double riveted butt joint with two cover plates for longitudinal beam of a boiler shell 1.5 m in diameter subjected to steam pressure of  $0.95 \text{ N/mm}^2$ . Assume joint efficiency as 75%, allowable tensile stress is  $90 \text{ N/mm}^2$ , crushing stress is  $140 \text{ N/mm}^2$  and shear stress is  $56 \text{ N/mm}^2$ . (12 Marks)

OR

- 8 a. A solid circular shaft 25 mm in diameter is welded to a support by means of a fillet weld as shown in Fig.Q8(a). Determine the leg dimensions of the weld if the permissible shear stress is  $95 \text{ N/mm}^2$ .

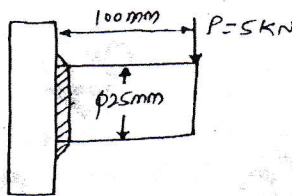


Fig.Q8(a) (06 Marks)

- b. A bracket is welded to a side column as shown in Fig.Q8(b) with a permissible stress of  $80 \text{ N/mm}^2$ . Determine the maximum load that the bracket can withstand if the size of the weld is 10 mm.

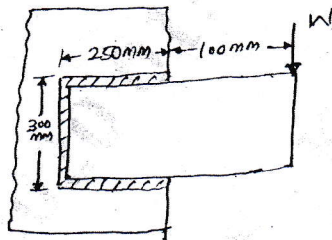


Fig.Q8(b) (10 Marks)

Module-5

- 9 a. Explain the various type of stresses in thread fasteners. (06 Marks)
- b. A flat circular plate is used to close the flanged end of a pressure vessel of internal diameter 300 mm. The vessel carries a fluid at a pressure of  $0.7 \text{ N/mm}^2$ . A soft copper gasket is used to make the joint leak proof. Twelve bolts are used to fasten the cover plate onto the pressure vessel. Find the size of bolts so that the stress in the bolts is not to exceed  $100 \text{ N/mm}^2$ . (10 Marks)

OR

- 10 a. Derive an expression for torque required to lift the load on square threaded screw. (06 Marks)
- b. A machine slide weighing 20 kN is raised by a double start square threaded screw at the rate of 0.84 m/min. The coefficient of friction for screw and collar is 0.12 and 0.14 respectively. The outside diameter of the screw is 44 mm and pitch is 7 mm. The outside and inside diameters of the collar at the end of the screw are 58 mm and 32 mm respectively. Calculate the power required to drive the slide and efficiency. If the allowable shear stress in the screw

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15ME562

## Fifth Semester B.E. Degree Examination, Aug./Sept.2020 Energy and Environment

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

### Module-1

- 1 a. Differentiate Energy and Power. List the different types of energies. (08 Marks)  
b. Discuss the demand and access to modern energy aspects with respect to key energy trends in India. (08 Marks)

OR

- 2 a. Differentiate between primary and secondary energy sources. List the various primary energy sources. (08 Marks)  
b. What are the factors affecting India's energy development? Explain any two factors. (08 Marks)

### Module-2

- 3 a. Which are the different Thermal energy storage methods? (06 Marks)  
b. What is Energy Audit? Explain the methodology used in Energy Audit. (10 Marks)

OR

- 4 a. Explain the various factors which affect energy pricing. (08 Marks)  
b. What is Economic analysis of a project? What are the steps involved in economic analysis. (08 Marks)

### Module-3

- 5 a. Explain the importance of Environmental education and Public awareness in the present day context. (10 Marks)  
b. Explain the concept of Ecological pyramid. (06 Marks)

OR

- 6 a. Explain the components of Environment and the impact of urbanization on them. (10 Marks)  
b. Discuss the Environmental factors affecting the performance of an aquatic ecosystem. (06 Marks)

### Module-4

- 7 a. List the major air pollutants and explain their effect on human beings. (08 Marks)  
b. Explain the role of an individual in prevention of pollution. (08 Marks)

OR

- 8 a. Explain the working of any two air pollution control equipments mentioning their advantages, disadvantages and application. (08 Marks)  
b. What is Hazardous Waste? Explain disposal methods for hazardous wastes. (08 Marks)

### Module-5

- 9 a. What are the causes and effects of acid rain? (06 Marks)  
b. Write short notes on :  
i) The water (Prevention and Control of Pollution) Act, 1974.  
ii) The Wildlife Protection Act 1971. (10 Marks)

OR

- 10 a. Explain the affect of nuclear hazards and accidents, with a case study. (08 Marks)  
b. Discuss the possible impact of ozone depletion and global warming on the eco system. (08 Marks)

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Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8 = 50, will be treated as malpractice.