

University of Asia Pacific
Department of Basic Sciences and Humanities
Final Examination, Fall-2022
Program: B.Sc. Engineering (Civil)

Course Title: Physics I
Time: 3.0 Hours

Credit Hours: 3.0

Course Code: PHY 101
Full Marks: 150

There are **EIGHT** questions. Answer **SIX** including questions **1, 2, 5 and 6**. Figures in the right margin indicate marks.

1. a) Deduce the differential equation of simple harmonic motion and solve it to obtain an expression for the displacement of a particle executing simple harmonic motion. 20
- b) The equation of a particle executing simple harmonic motion is given by 05

$$x = 12 \sin\left(\frac{2\pi t}{10} + \frac{\pi}{4}\right)$$

Calculate

- i) amplitude
ii) frequency
iii) phase
iv) displacement at $t = 1.25$ second.
2. a) State and explain Malus law. 05
- b) Write short notes on theories of light. 20
3. a) State and explain first law of thermodynamics. 10
- b) Show that for adiabatic process $PV^\gamma = \text{constant}$, where the symbols have their usual meanings. 15
- OR**
4. a) Define Carnot cycle. Find out the total work done on a Carnot cycle. 20
- b) Explain internal energy. 05
5. a) Show that total energy of a body executing simple harmonic motion is $2\pi^2 m f^2 A^2$, where the symbols have their usual meanings. 15
- b) Explain briefly heavy damping and critical damping. 10

6. a) What are Lissajous figures? Derive the resultant equation of two simple harmonic motions of equal time period when they act at right angles to one another and show that the equation represents an ellipse. Find out what will happen if the initial phase angle is (i) zero and (ii) $\frac{\pi}{2}$. 20
- b) Two simple harmonic motions acting simultaneously on a particle are given by the equations 05

$$Y_1 = 2 \sin\left(\omega t + \frac{\pi}{6}\right)$$

$$Y_2 = 3 \sin\left(\omega t + \frac{\pi}{3}\right)$$

Calculate

- (i) amplitude
 - (ii) phase constant
 - (iii) equation of the resultant motion.
7. a) Show that the fringe width between two consecutive bright fringes is $X = \frac{\lambda D}{d}$, where the symbols have their usual meanings. 20
- b) Explain diffraction of light. 05

OR

8. a) Show that the equation for the intensity at a point on the screen in Young's experiment can be written as 20

$$I = 4a^2 \cos^2 \frac{\delta}{2}$$

where a and δ are the wave amplitude and the phase difference respectively between the two waves reaching the point considered. Using this equation find out the conditions under which bright and dark fringes can be observed in interference pattern.

- b) Explain the conditions for interference of light. 05

University of Asia Pacific
Department of Basic Sciences and Humanities
Final Examination, Fall-2022
Program: B.Sc. Engineering (Civil)

Course Title: Mathematics I

Course Code: MTH 101

Credit Hours: 3

Time: 3.00 Hours

Full Marks: 150

There are **EIGHT** questions. Answer **SIX** including questions **1, 2, 3 and 4**. All questions are of equal value. Figures in the right margin indicate marks.

1. (a) Evaluate $\lim_{n \rightarrow \infty} \left\{ \left(1 + \frac{1}{n^2}\right)^{\frac{2}{n^2}} \left(1 + \frac{2^2}{n^2}\right)^{\frac{4}{n^2}} \left(1 + \frac{3^2}{n^2}\right)^{\frac{6}{n^2}} \dots \left(1 + \frac{n^2}{n^2}\right)^{\frac{2n}{n^2}} \right\}$. 15
- (b) Integrate any two of the followings: 10
- (i) $\int \frac{dx}{(2x+1)\sqrt{4x+3}}$ (ii) $\int \frac{dx}{3+2\cos x}$ (iii) $\int \frac{1}{\sqrt{x^2+x+1}} dx$
2. (a) Apply method of breaking up into partial fractions to demonstrate the integral 10
- $\int_{-1}^2 \frac{x}{(x-1)(x^2+4)} dx$.
- (b) Evaluate (i) $\int_0^{\frac{\pi}{2}} \frac{\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}} dx$ (ii) $\int_0^{\frac{\pi}{2}} \sin^6 \theta \cos^3 \theta d\theta$ 15
3. (a) Obtain reduction formula for $\int_0^{\frac{\pi}{2}} \sin^n x dx$. Use the formula to evaluate 15
- $\int_0^{\frac{\pi}{2}} \sin^4 x dx$.
- (b) Deduce reduction formula for the integral $\int x^n e^{ax} dx$. 10
4. (a) Find the area above the x - axis, included between the parabola $y^2 = bx$ and the 15
- circle $x^2 + y^2 - 2bx = 0$.
- (b) Find the area bounded by the Cardioid $r = a(1 - \cos \theta)$. 10

5. (a) The circle $x^2 + y^2 = a^2$ revolves round the x -axis. Find the surface area and the volume of the whole surface generated. 15
- (b) Find the area of the surface that is generated by revolving the portion of the curve $y = x^2$ between $x = 1$ and $x = 2$ about the y -axis. 10

OR

6. (a) Show that $\int_0^{\frac{\pi}{2}} \sin^p \theta \cos^q \theta d\theta = \frac{\Gamma\left(\frac{p+1}{2}\right)\Gamma\left(\frac{q+1}{2}\right)}{2\Gamma\left(\frac{p+q+2}{2}\right)}$. 15

(b) Prove that $\overline{\binom{n+1}{k}} = n! \binom{n}{k}$. 10

7. (a) State Euler's theorem on homogeneous function. If $u = \tan^{-1}\left(\frac{x^3 + y^3}{x + y}\right)$, then prove that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \sin 2u$. 10

- (b) A fast-food restaurant determines the profit function for its hamburgers as follows: $P(x) = 2x^3 - 6x^2 - 18x + 7$. Compute the maximum points, minimum points & inflection points. 15

OR

8. (a) Integrate the following with respect to x using integration by parts $\int e^{px} \sin qx dx$. 10

- (b) State the Leibnitz's theorem. If $y = e^{a \cos^{-1} x}$, then show that 15

$$(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - (n^2 + a^2)y_n = 0.$$

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2022
Program: B. Sc. Engineering (Civil)

Course Title: Engineering Mechanics
 Time: 3 hours

Credit Hours: 3.0

Course Code: CE 101
 Full Marks: 100 (= 10 × 10)

ANSWER ALL THE QUESTIONS

1. Locate the centroid of the composite area shown in **Fig.1** with respect to the given coordinate system.
2. In the structure shown in **Fig.2**, draw the free-body diagram of member *abc*, *be*, *aed*; supports at *c* and *d* [Consider all the members are weightless].

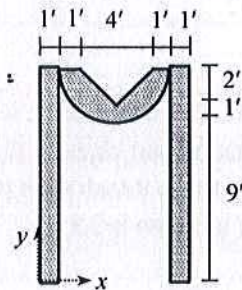


Fig.1

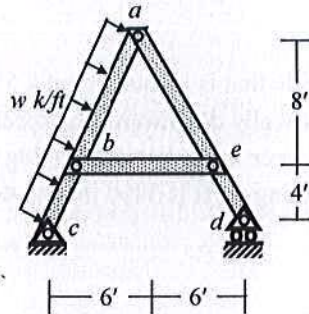


Fig.2

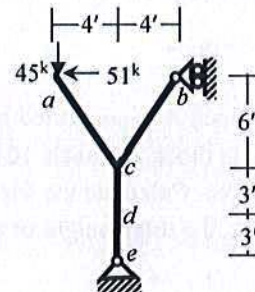


Fig.3

3. For the frame *abcde* loaded as shown in **Fig.3**, calculate the (i) reactions at supports *b* and *e* (ii) shear force and bending moment at *d* (mid-point of member *ce*).
4. Locate the centroid of the composite line shown in **Fig.4** with respect to the given coordinate system.

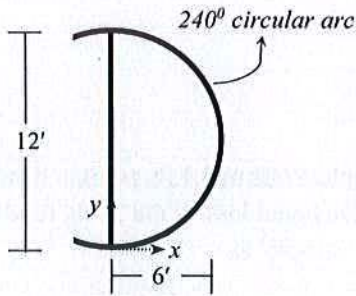


Fig.4

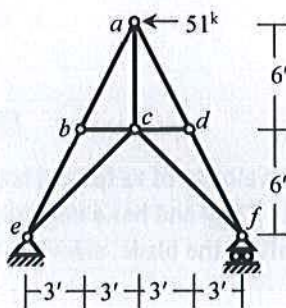


Fig.5

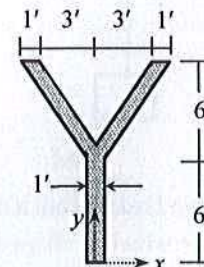
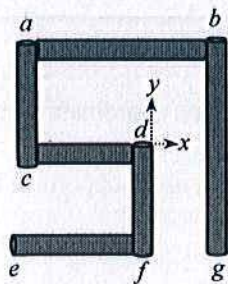


Fig.6

5. In the truss loaded as shown in **Fig.5**, (i) identify the zero force members, (ii) Calculate the reactions at supports, and (iii) Calculate forces in members *ab* and *ac*.
6. Compute the moment of inertia I_x and I_y , as well as radius of gyration k_x and k_y , of the composite area with respect to given coordinate system shown in **Fig.6**.

7. Compute the moment of inertia I_y of the composite mass with respect to y -axis for the coordinate system shown in **Fig.7**.



Member	Type	Diameter (ft)	Length (ft)	Unit weight (lb/ft ³)
<i>ab</i>	Cylinder	1	10	51
<i>cd</i>	Cylinder	1	6	51
<i>ef</i>	Cylinder	1	7	51
<i>ac</i>	Cylinder	1	6.5	101
<i>df</i>	Cylinder	1	6.5	101
<i>bg</i>	Cylinder	1	12	101

Fig.7

8. In **Fig.8**, Block A is supported by a cable that is wound about a 5' drum. A 10-ft flywheel turns with the drum. While block A travels 101 ft vertically downward, the speed of the rotating part changes from 5.1 rpm to 70 rpm. Calculate the frictional force in the bearings acting tangentially to the 8-inch shaft [Given, $W_A=510$ lb., the total weight of the rotating parts is 3900 lb. and the radius of gyration is 3.9 ft].

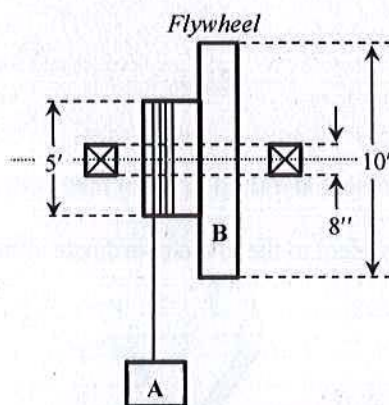


Fig.8

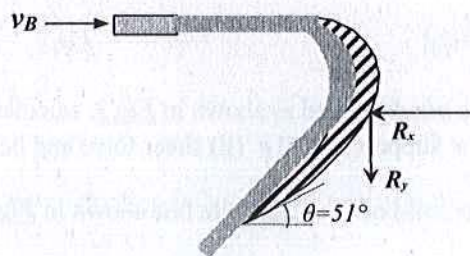


Fig.9

9. A jet of steam issued from a nozzle with a velocity of v_B fps and an absolute rate of 5.1 lb. per sec. It enters a fixed blade which is shaped as shown in **Fig.9** and has a negligible frictional loss. If the 51 lb. resultant force acts at an angle 39° (with horizontal) on the blade, calculate the velocity v_B .
10. The rotating assembly shown in **Fig.10** consists of block A, block B, and rotating body C. Given, $W_A=510$ lb., $W_B=390$ lb., $Q=151$ lb., and co-efficient of friction between object A and the surface is 0.39. Body A is moving leftwards and B is moving downwards with velocity v . If Force Q brings the bodies to rest in 5.1 seconds, calculate the velocity v and tension in the cable.

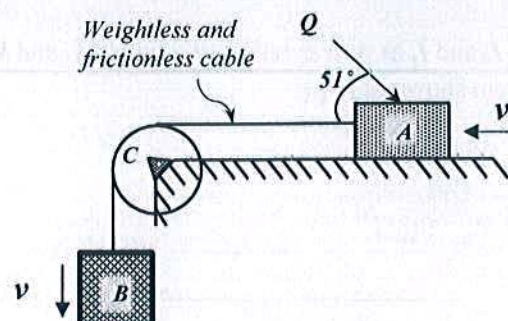


Fig.10

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall-2022
Program: B.Sc. in Civil Engineering (1st Year/1st Semester)

Course Title: Basic Electrical and Electronic Engineering Crédit Hour: 3.00
 Time: 3 hours

Course Code: ECE 101
 Full Marks: 150

[There are **Eight** Questions. Answer **Six** questions including **Question 1, 2, 3 and 4**. Figures in the right margin indicate marks.]

1. a) Calculate the charge stored on a 40- μF capacitor with 60V across it. Find the energy stored in the capacitor. [6]
- b) What is inductor and how it is different from capacitor? Determine the equivalent inductance of the circuit in Figure:1(a) [7]

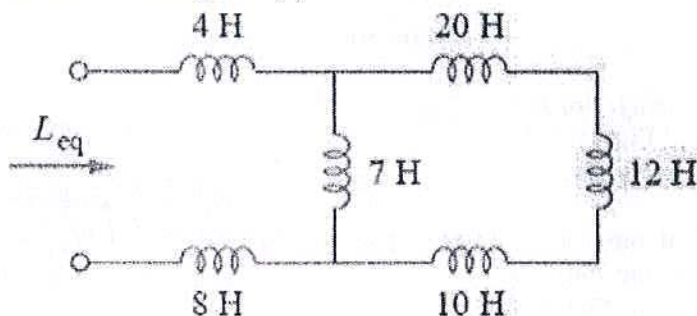


Figure:1(a)

- c) Determine the equivalent capacitance at terminals a-b of the circuit in Figure:1(b) [12]

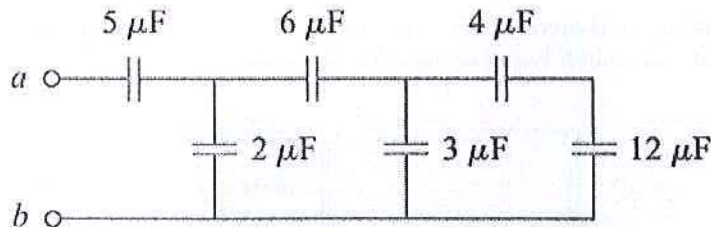


Figure:1(b)

2. a) Derive the RMS value and average value of a pure sinusoidal current waveform. Also derive the expression of power considering a pure sinusoidal voltage across a resistive element only. [15]
- b) Find the RMS values of the following sinusoidal waveforms. Find the phase relationship between them and also show their waveshapes on the same graph. [10]
 - i. $v = 10 \sin(\omega t - 20^\circ)$
 - ii. $i = -2 \cos(\omega t - 60^\circ)$

3. a) Using complex algebra, find the total impedance Z_T in polar form in figure 3(a). [15]
Find the current I and the voltages V_R and V_L in phasor form. Draw the phasor diagrams of the voltages E , V_R , and V_L , and the current I .

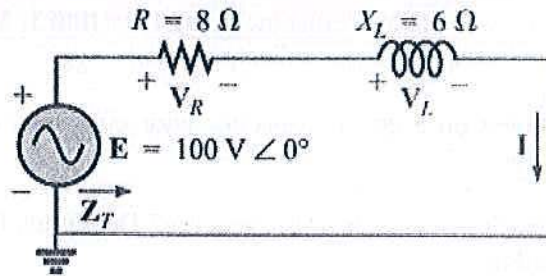
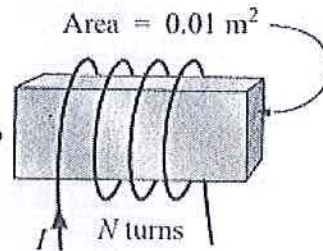


Figure: 3(a)

- b) Define Flux Density. For the electromagnet of Figure: 3(b) Find the flux density in the core.
c) If the number of turns is 10 and the current flowing through the turn is 10A then find the magnetomotive force.

$\Phi = 4 \times 10^{-4} \text{ Wb}$



[10]

Figure: 3(b)

4. For the following civil layout shown in Figure : 4, draw the fitting & fixture layout, [25]
conduit layout and switch board connection diagram.

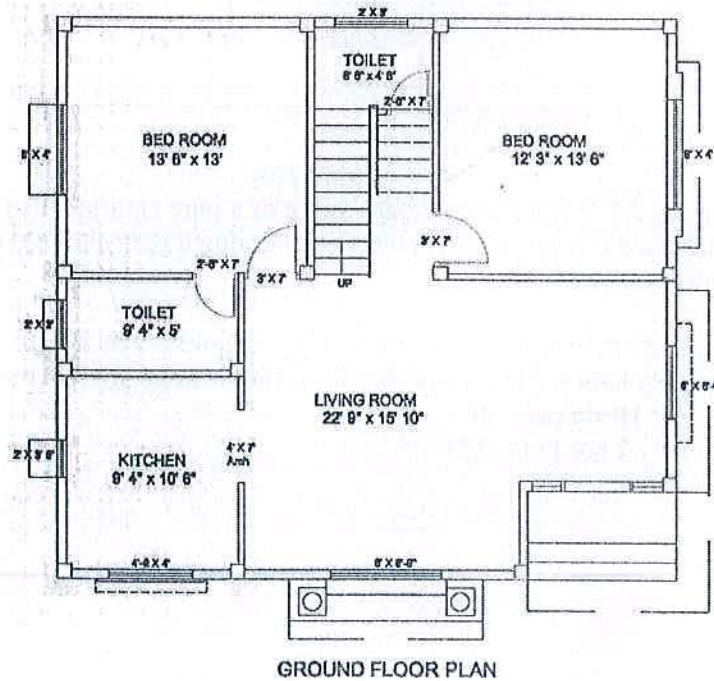


Figure: 4

5. For the series-parallel network of Figure: 5-

[25]

- i. Calculate Z_T .
- ii. Determine I , I_1 , I_2 and I_3
- iii. Find V_L
- iv. Find the total power factor.
- v. Find the average power delivered to the circuit.

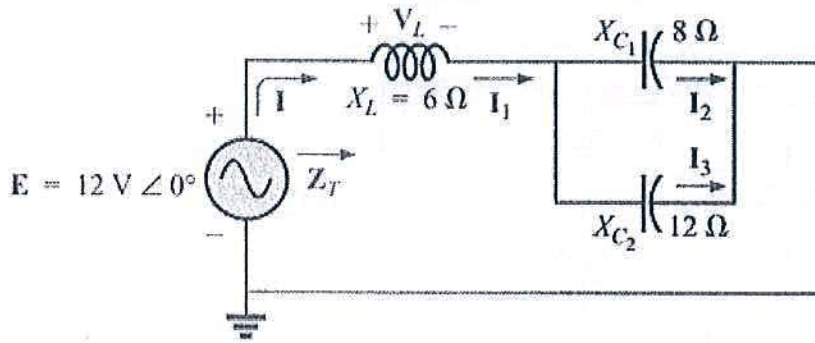


Figure: 5

OR

6. For the series-parallel network of Figure: 6-

[25]

- i. Find the total impedance Z_T .
- ii. Determine the current I_s and I_C .
- iii. Calculate V_L .
- iv. Find the total power factor.
- v. Find the average power delivered to the circuit.

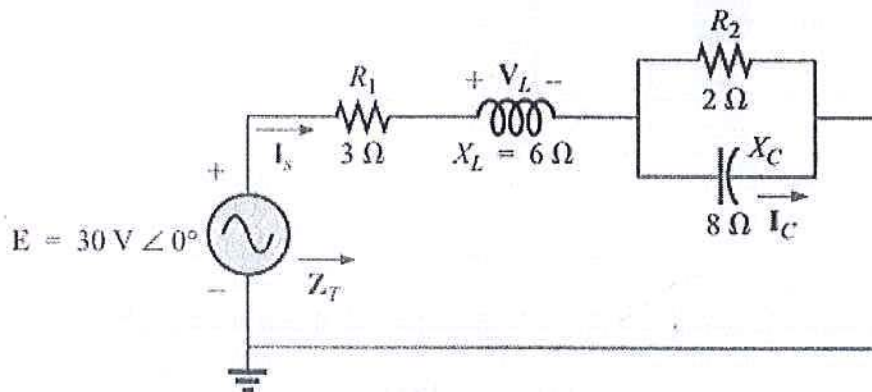


Figure: 6

7. a) Find the value of R for maximum power transfer in the circuit of Figure: 7(a). [12]
Find the maximum power.

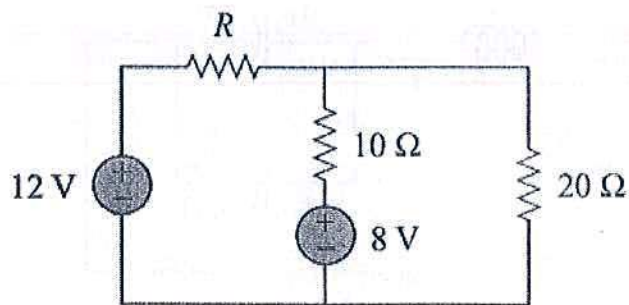


Figure: 7(a)

- b) Determine the Thevenin equivalent R_{Th} and I_{Th} between terminals a and b of the circuit in Figure: 7(b). [13]

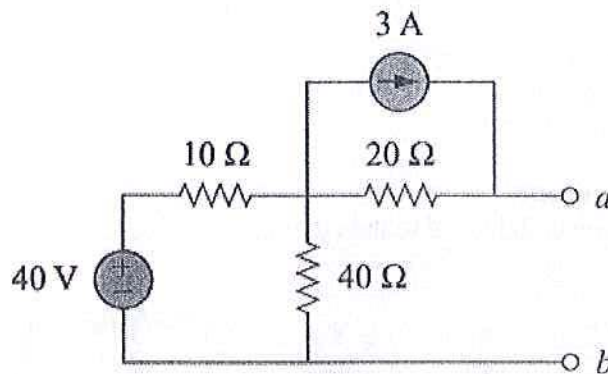


Figure: 7(b)

OR

8. a) Use superposition principle to determine the current i as shown in Figure: 8(a). [12]

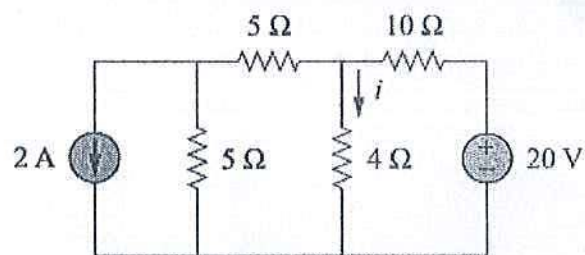


Figure: 8(a)

- b) Determine the Norton equivalent R_N and I_N between the terminals a and b of the circuit in Figure: 8(b) [13]

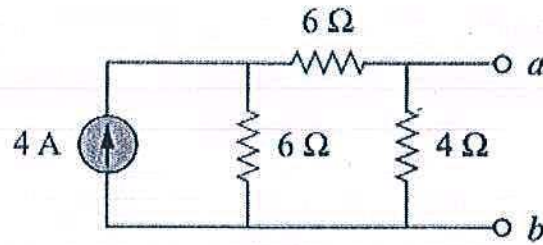


Figure: 8(b)

University of Asia Pacific
Department of Basic Sciences and Humanities
Final Examination, Fall 2022
Program: B. Sc. Engineering (Civil)

Course Title: History of Bangladesh Independence, Society and Culture
Time: 03 Hours

Credit Hours: 03

Course Code: HSS 105
Full Marks: 150

Use separate answer scripts for Part-A and Part-B. All questions are of equal value. Figures in the right margin indicate marks.

Part - A

Answer ANY THREE including Q-1 and Q-2.

1. Discuss the main features of the constitution of Pakistan of 1956. 25
 2. a. Explain the Six-point Program. 15
b. Discuss the significance of the Six-point Program. 10
 3. Describe the background of the Liberation war of Bangladesh in 1971. 25
- OR
4. Describe the role of the super powers in the Liberation war of Bangladesh in 1971. 25

Part - B

Answer ANY THREE including Q-5 and Q-6.

5. a. What do you mean by social change? Discuss the sources of social change with examples. 10
b. Discuss the origin and development of sociology. 15
 6. a. What is social order? Discuss how we learn social order. 10
b. Discuss the contribution of European scholars in Sociology. 15
 7. a. Define and distinguish between industrial and post-industrial society. 10
b. What is the mode of production? Make a comparative discussion between 'primitive communism' and 'communism' as modes of production. 15
- OR
8. a. Discuss slavery and feudalism as modes of production. 10
b. What are capitalism and socialism? Discuss the different features of capitalism and socialism. 15