

SV - 816

Total No. of Pages : 2

Seat No.	
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**F.E. (Semester - I & II) Examination, May - 2019**

**Basic Mechanical Engineering (All Branches)**

**Sub. Code : 59186**

**Day and Date : Friday, 17 - 05 - 2019**

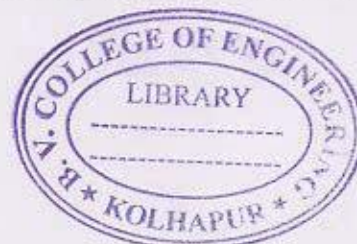
**Total Marks : 100**

**Time : 10.00 a.m. to 01.00 p.m.**

- Instructions :**
- 1) Attempt any three questions from each section.
  - 2) Figures to right indicate full marks.
  - 3) Assume suitable data wherever required and state it clearly.

**SECTION - I**

- Q1) a)** State statements of second law of thermodynamics with example. [6]  
**b)** Following data is obtained from an air compressor, Pressure at inlet is  $100 \times 10^3 \text{N/m}^2$ , Pressure at outlet is  $500 \times 10^3 \text{N/m}^2$ , Specific volume at inlet is  $0.6 \text{m}^3/\text{kg}$  and at outlet is  $0.15 \text{m}^3/\text{kg}$ . When air is absorbed the internal energy of air is  $50 \text{KJ/Kg}$  and when it is delivered its internal energy is  $125 \text{KJ/Kg}$ . The velocity of air at inlet is  $8 \text{m/s}$  and at outlet  $4 \text{m/s}$ . Inlet is  $6 \text{m}$  above the surface and it delivers at  $2 \text{m}$ , rate of air flow through compressor is  $5 \text{kg/s}$ . The heat rejected by compressor is  $45 \text{KW}$ . Determine necessary power required. [10]
- Q2) a)** Describe working of four stroke CI engine with neat sketch. [8]  
**b)** Sketch otto cycle with P-V and T-S diagram. Derive its expression for its air standard efficiency. [8]
- Q3) a)** Explain construction and working of vapour compression refrigeration system. [8]  
**b)** Enumerate properties of good refrigerant. [8]
- Q4) a)** Explain with neat sketch Window Air Conditioner. [8]  
**b)** Differentiate between SI engine and CI engine. [6]  
**c)** Differentiate Macroscopic and Microscopic view in thermodynamics. [4]



**P.T.O.**



SECTION - II

- Q5) a) Explain with neat sketch construction, working, advantages and disadvantages of hydroelectric power plant. [8]  
b) Explain construction and working of Biogas plant. [4]  
c) Differentiate renewable and non-renewable energy sources [4]
- Q6) a) Explain with neat sketch working of Francis turbine. [8]  
b) Two pulleys having diameter 2m and 1.5m separated by distance of 5m, Maximum tension in belt is 3KN, Coefficient of friction is 0.3. Calculate power transmitted by open belt when smaller pulley rotates at 200rpm also calculate length of belt. [8]
- Q7) a) Explain basic steps involved in casting process. [8]  
b) Explain metal removing process and its applications. [8]
- Q8) Write short note on the following : [18]  
a) Soldering and Brazing  
b) Solar refrigeration  
c) Centrifugal pump

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Seat No.	
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SV - 622

Total No. of Pages : 2

First Year B.Tech. (Semester - I & II) (CBCS) Examination, May - 2019

**BASIC CIVIL ENGINEERING (All Branches)**

**Sub. Code : 71813**

Day and Date : Friday, 10 - 05 - 2019

Total Marks : 70

Time : 10.00 a.m. to 12.30 p.m.

- Instructions :
- 1) Attempt any Three questions from Each Section.
  - 2) Figures to the right indicate full marks.
  - 3) Make suitable assumptions wherever necessary and mention it clearly.
  - 4) Use of non-programmable calculator is allowed.

**SECTION - I**

- Q1)** a) Explain co-relevance of Civil Engineering with other branches of Engineering in detail. [6]  
b) Explain Aspect, Prospect and Ventilation as a building planning principles. [6]
- Q2)** a) Explain with a neat sketch the different elements of super-structure of building. [6]  
b) Explain the various types of soil and rocks as foundation strata. [5]
- Q3)** a) Explain in brief the desired engineering properties of bricks & timber. [6]  
b) What are ingredients of concrete? Write note on R.M.C. [5]
- Q4)** Attempt any three of the following. [12]  
a) What is F.S.I.? Give its significance.  
b) What are various factors affecting bearing capacity of soil?  
c) Write a note on Pile foundation.  
d) What are the types of roofing materials commonly used in building?



P.T.O.



SECTION - II

- Q5) a) Write a short note on errors in chaining. [3]  
 b) The following bearings were taken with a prismatic compass in running a closed traverse. [8]

Line	AB	BC	CD	DA
F.B.	124°30'	68°30'	310°30'	200°30'
B.B.	304°30'	246°0'	135°0'	18°30'

- i) Plot the traverse and show all F.B. and B.B. on it.  
 ii) Find out the included angles.  
 iii) Calculate corrected F.B. and B.B.
- Q6) a) Write short note on EDM. [4]  
 b) The following consecutive readings were taken with a dumpy level and a 4m Leveling staff on a continuously sloping ground at a common interval of 30 m.  
 0.780, 1.535, 1.955, 2.430, 2.985, 3.480, 1.155,  
 1.960, 2.365, 3.640, 0.935, 1.045, 1.630 and 2.545.  
 The R.L. of first station was 180.750m. Make entries in the level field book and enter above readings. Determine gradient of line joining, first and last stations. Use rise and fall method. Calculate RI of points. [8]
- Q7) a) Write a note on gravity dam with the help of neat sketch. [5]  
 b) Explain with the neat diagram functions of various components of water supply scheme. [6]
- Q8) Attempt any Three from the following : [12]  
 a) Explain the process of chaining & ranging.  
 b) Explain various uses of contour map.  
 c) Draw a neat sketch of broad gauge railway track & explain its components.  
 d) The line was measured on a falling gradient of 1 in 10 with a 30m chain length. The chain was found to be 6cm too short. Find the correct horizontal distance if the measured length of the line was 378m.





Seat No.	
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**F.E.B.Tech. (All branches) (Semester - I & II) Examination, April - 2019**  
**ENGINEERING PHYSICS (New CBCS Syllabus)**  
**Sub. Code : 71811**

Day and Date : Saturday, 27 - 04 - 2019

Total Marks : 70

Time : 10.00 a.m. to 12.30 p.m.

- Instructions:
- 1) Attempt any three questions from each section.
  - 2) Figures to the right indicate full marks.
  - 3) Given: Avogadro's number.  $N = 6.023 \times 10^{26}/\text{kg atom}$ , mass of electron =  $9.1 \times 10^{-31} \text{ kg}$ , charge of electron =  $1.6 \times 10^{-19} \text{ C}$ , Speed of light,  $C = 3 \times 10^8 \text{ m/s}$ , Plank's constant,  $h = 6.63 \times 10^{-34} \text{ Js}$ .

**Section - I**

Q1) Answer the following questions.

[6]

- a) State the difference between
  - i) Ordinary and Extraordinary ray
  - ii) Positive and Negative crystal
- b) Define the term diffraction grating and grating element. Calculate the wavelength of spectral line, when a parallel beam of sodium light is allowed to incident normally on a plane grating having 5250 lines per cm and second order line is observed to be deviated through  $45^\circ$ .

[6]

Q2) Answer the following questions.

- a) Explain the terms: spontaneous emission, population inversion and stimulated emission.
- b) Explain the working principle and structure of optical fibre.

[6]

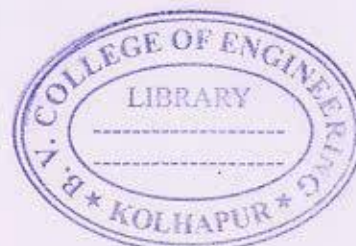
[5]

Q3) Answer the following questions.

- a) State the factors affecting on the acoustics of auditorium and explain their remedies.
- b) Define reverberation time and absorption coefficient. State and explain Sabine's formula.

[6]

[5]



P.T.O.



Q4) Answer any two from the following questions.

- Derive an expression for resolving power of diffraction grating. [6]
- The refractive index of core is 1.6 and fractional refractive index change is 0.015. Calculate the refractive index of cladding, numerical aperture and acceptance angle for an optical fibre. [6]
- A room has a volume of  $1000 \text{ m}^3$  the total wall area is  $200 \text{ m}^2$  the total floor area is  $100 \text{ m}^2$  and the total ceiling area is  $100 \text{ m}^2$ . The average sound absorption coefficient for wall is 0.02. ceiling is 0.8 and floor is 0.05. Determine the average absorption coefficient and the reverberation time. [6]

### Section - II

Q5) Answer the following questions.

- Determine number of atoms per unit cell and coordination number for SC, BCC and FCC lattice. [6]
- (i) Draw (010), (110) and (111) planes in the simple cubic crystal. [3]  
(ii) Determine the spacing between (110) and (111) planes in NaCl crystal having Lattice constant  $a = 5.64 \text{ \AA}$ . [3]

Q6) Answer the following questions.

- What are nanomaterials? Explain the construction and working of atomic force microscope with a neat sketch. [6]
- Describe ball milling method used for synthesis of Nano particle. [5]

Q7) Answer the following questions.

- What do you mean by dual nature of light? Derive an expression for de Broglie's Wavelength associated with an electron accelerated through a potential difference  $V$  volt. [6]
- Explain properties of matter waves. [5]

Q8) Answer any two from the following questions.

- With neat diagram explain diad, triad and tetrad axis of cubic crystal system. [6]
- Write note on applications of nanomaterial. [6]
- find the wavelength associated with an electron moving with velocity of  $0.3c$ . Where  $c$  - is the speed of light.
  - Calculate change in wavelength of X rays due to compton scattering at an angle of  $30^\circ$ . [6]





SV - 617

Seat No.	
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Total No. of Pages : 2

**F.Y. B.Tech (All Branches) (Part - I) (Semester - II) Examination,  
April - 2019**

**ENGINEERING MATHEMATICS - II (CBCS)**

**Sub. Code : 72500**

**Day and Date : Thursday, 25 - 04 - 2019**

**Total Marks : 70**

**Time : 10.00 a.m. to 12.30 p.m.**

**Instructions :** 1) Attempt any three questions from each section.

2) Figures to right indicate full marks.

3) Use of non-programmable calculator is allowed.

**SECTION - I**

**Q1) a)** Solve  $\sin y \frac{dy}{dx} - \cos y = x \cos^2 y$  [6]

**b)** Solve  $(ye^{xy} - \tan x) dx + (xe^{xy} - \sec y) dy = 0$  [6]

**Q2) a)** Find the orthogonal trajectories of  $x^2 + y^2 = ax$  [6]

**b)** The current in a circuit containing inductance  $L$ , resistance  $R$  and voltage  $E \sin \omega t$  is given by  $L \frac{di}{dt} + Ri = E \sin \omega t$ . If there is no current initially in the circuit then show that the current at any time  $t$  is given by

$$\frac{E}{\sqrt{R^2 + \omega^2 L^2}} \sin(\omega t - \phi) + \sin \phi e^{-Rt/L} \text{ where } \phi = \tan^{-1} \frac{L\omega}{R} \quad [5]$$

**Q3) a)** Find the solution of  $(y^2 - x - 1)dx + dy = 0$  at  $x = 0.4$  by modified Euler's method using  $h = 0.2$  if  $y(0) = 1$  [6]

**b)** Find  $y$  at  $x = 0.2$  if  $\frac{dy}{dx} = \frac{(2x-1)y}{x^2} + 1$  and  $y(1) = 2$  by Runge Kutta's fourth order method. [5]



**P.T.O.**



Q4) Attempt any two of the following:

[12]

- a) Solve  $y(xy + 2x^2y^2)dx + x(xy + x^2y^2) dy = 0$
- b) Temperature of water initially is  $100^\circ\text{C}$  and that of surrounding is  $20^\circ\text{C}$ . If water cools down to  $60^\circ\text{C}$  in first 20 minutes, during what time will it come to  $30^\circ\text{C}$ .
- c) Solve  $\frac{dy}{dx} = x^2 + y^2$  with  $y(1) = 0$  for  $x = 1.3$  by Taylor's series method correct upto 4 places of decimals.

SECTION - II

- Q5) a) Find one root of the equation  $3x - \cos x - 1 = 0$  by Bisection method [6]
- b) Find one root of the equation  $e^{-x} = 5x - 1$  by Newton Raphson method [6]

Q6) a) Evaluate  $\int_0^1 \left[ \log \left[ \frac{1}{x} \right] \right]^5 x^{\frac{5}{2}} dx$  [5]

b) Evaluate  $\int_0^\pi x \cos^6 x dx$  [6]

- Q7) a) Evaluate by changing the order of integration [6]

$$\int_0^a \int_{\frac{y}{a}}^{\frac{y}{x}} \frac{y dx dy}{(a-x)\sqrt{ax-y^2}}$$

- b) Find by double integration the area enclosed between the curves  $y^2 = x^3$  and  $y = x$ . [5]

Q8) Attempt any two of the following

- a) Find one root of the equation by Secant method  $e^x = x^4$  [6]
- b) Express  $\text{erf}(x)$  in series and evaluate  $\text{erf}(0.3)$  [6]
- c) Change into polar coordinates and evaluate [6]

$$\int_0^{4a} \int_{\frac{y}{2}}^{\frac{y}{4a}} dx dy$$





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**F.E. (All Branches) (Part - I) (Semester - I & II) Examination,  
May - 2019**

**FUNDAMENTALS OF ELECTRONICS AND COMPUTERS**

**Sub. Code : 59184**

**Day and Date : Wednesday, 08 - 05 - 2019**

**Total Marks : 100**

**Time : 10.00 a.m. to 01.00 p.m.**

- Instructions :**
- 1) All questions are compulsory.
  - 2) Figures to the right indicate full marks.
  - 3) Assume suitable data, if necessary.

**Q1) Solve any two : [16]**

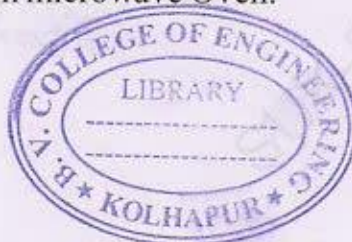
- a) Explain common collector(CC) configuration of BJT with input and output characteristics. Derive the relationship between  $\alpha$ ,  $\beta$ , and  $\gamma$ .
- b) What is operating point? Draw and explain AC/Dc loadline.
- c) Explain Full wave bridge rectifier with necessary waveform.

**Q2) Solve any two : [16]**

- a) Explain full adder circuit with truth table.
- b) Explain basic gates and NOR as universal gate with its truth table.
- c) What is multiplexer? Explain 4:1 multiplexer with truth table.

**Q3) Solve any two : [18]**

- a) Explain speed transducer with advantages and disadvantages.
- b) Explain digital thermometer with its block diagram.
- c) With a neat block diagram, Explain microwave Oven.



**P.T.O**



**Q4) Solve any two :**

**[16]**

- a) Discuss the different generations of computers.
- b) Enlist any four inputs and output devices and explain their use.
- c) Give the classification of computers based on their speed.

**Q5) Solve any two :**

**[16]**

- a) Explain following Linux commands
  - i) Ls
  - ii) Mkdir
  - iii) Rmdir
  - iv) cd
- b) What is software? Differentiate between system software and application software.
- c) Explain the characteristics and applications of Spreadsheet.

**Q6) Solve any two :**

**[18]**

- a) What is an algorithm? Write an algorithm, to read marks of six subjects out of 50 marks. Calculate average and percentage.
- b) Explain different network topologies?
- c) Convert number system ( $3 \times 3 = 9M$ )
  - i) 110101,0110 Binary to Decimal
  - ii) 4327 Hexadecimal to Decimal
  - iii) 174 Decimal to Octal





**V.B. Tech. (Semester - I & II) (CBCS) Examination, May - 2019**  
**ENGINEERING CHEMISTRY (All Branches)**

**Sub. Code : 71817**

**Day and Date : Friday, 03 - 05 - 2019**

**Total Marks : 70**

**Time : 10.00 a.m. to 12.30 p.m.**

- Instructions:**
- 1) Attempt any three questions from each section.
  - 2) Figures to the right indicate full marks.
  - 3) Draw neat labeled diagram wherever necessary.
  - 4) Use of non-programmable calculator is allowed.

**SECTION - I**

- Q1) a) A sample of water on analysis was found to contain the following impurities [6]

	Wt.mg/lit	Mol.wt.
$\text{Ca}(\text{HCO}_3)_2$	19	162
$\text{Mg}(\text{HCO}_3)_2$	17	146
$\text{CaCl}_2$	15	111
$\text{MgSO}_4$	20	120

Calculate temporary, permanent and total hardness of water in ppm.

- b) Explain reverse osmosis technique for the treatment of hard water. [6]
- Q2) a) With schematic diagram, explain construction and working of single beam spectrophotometer. [6]
- b) Discuss the applications of GLC. [5]
- Q3) a) Distinguish between Thermosoftening and Thermosetting plastics. [6]
- b) Give the preparation, properties and application of Urea formaldehyde plastic. [5]



**P.T.O.**



SV - 608

Total No. of Pages : 3

Seat No.	
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**F.E. (Part - I) (All Branches) (Semester - II) (Revised) Examination,**

**April - 2019**

**ENGINEERING MATHEMATICS - II**

**Sub. Code : 59933**

**Day and Date : Thursday, 25 - 04 - 2019**

**Total Marks : 100**

**Time : 10.00 a.m. to 01.00 p.m.**

**Instructions : 1) All questions are compulsory.**

**2) Figures to the right indicate full marks.**

**3) Use of non-programmable calculator is allowed.**

**SECTION - I**

**Q1) Solve any three of the following. (5 marks each)**

**[15]**

a) Evaluate  $(ye^{xy} - \tan x)dx + (xe^{xy} - \sec y)dy = 0$

b) Evaluate  $y(xy + e^x)dx - e^x dy = 0$

c) Evaluate  $(1 + x^3)\frac{dy}{dx} + 6x^2y = e^x$

d) Evaluate  $\frac{dy}{dx} = x^3y^3 - xy$

**Q2) Attempt any Three of the following. (5 marks each)**

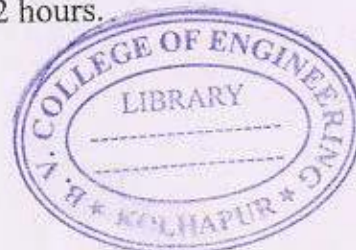
**[15]**

a) Find the Orthogonal Trajectories of  $x^2 + 4y^2 = a^2$ .

b) A current is flowing in a circuit of resistance  $R = 20\Omega$ , self inductance  $L = 0.05$  henries. If the current of 30amp flows at the beginning. Find its value after 0.01 sec, there being no external e.m.f.

c) A body at temp  $100^\circ\text{C}$  is placed in a room where temp is  $20^\circ\text{C}$  and cools to  $60^\circ\text{C}$  in a 5 minutes. Find its temp after a further interval of 3 minutes.

d) In a certain culture of bacteria, the rate of increase is proportional to the number present. If it is found that, the number doubles in 4 hours. How many be expected at the end of 12 hours.



**P.T.O.**



23) Attempt any FOUR of the following. (5 marks each) [20]

- Using Euler's method find the approximate value of  $y$  when  $x=0.5$  given then  $\frac{dy}{dx} = x^2 + y^2$  at  $y(0) = 0$ ,  $h = 0.1$ .
- Solve  $\frac{dy}{dx} = x + \sqrt{y}$  with  $y(0) = 1$  by Euler's Modified method at  $x = 0.2$
- Solve by Taylor's series  $\frac{dy}{dx} = y - xy$  with  $x_0 = 0, y_0 = 1$  when  $x = 0.1$
- Solve  $\frac{dy}{dx} = \sqrt{x+y}$  with  $x_0 = 0, y_0 = 1$  at  $x = 0.2$  by Runge-Kutta method of fourth order by taking  $h = 0.2$
- Using Runge-Kutta method of fourth order, find the approximate value of  $x$  and  $y$  at  $t = 0.2$  for following system.  $\frac{dx}{dt} = 2x + y, \frac{dy}{dt} = x - 3y, t = 0, x = 1, y = 0.5$  taking  $h = 0.1$

### SECTION - II

24) Attempt any three [15]

- Evaluate  $\int_0^\infty x^{-4} e^{-\frac{1}{x}} dx$
- Prove that  $\int_0^{\frac{\pi}{2}} \frac{1}{\sqrt{\sin \theta}} d\theta \times \int_0^{\frac{\pi}{2}} \sqrt{\sin \theta} d\theta = \pi$
- Prove that  $\int_0^1 \frac{x^a - x^b}{\log x} dx = \log \left[ \frac{a+1}{b+1} \right]$
- Find expression of  $\text{erf}(x)$  in terms of series.

[15]

25) Attempt any three

- Trace the curve  $ay^2 = x^2(a-x)$
- Trace the curve  $y^2 = (x-a)^3$
- Trace the curve  $r = a(1 - \sin \theta)$
- Find the length of cardioid  $r = a(1 - \cos \theta)$  which lies outside the circle  $r = a \cos \theta$ .

26) Attempt any four [20]

- Evaluate  $\int_1^2 \int_1^3 xy^2 dx dy$
- Evaluate  $\int_0^{\frac{\pi}{2}} \int_0^{a \cos \theta} r \sqrt{a^2 - r^2} dr d\theta$
- Change the order of integration and evaluate  $\int_0^1 \int_{\sqrt{x}}^1 e^{\frac{x}{y}} dx dy$
- Find the area between curve  $y^2 = 4ax$  and the chord AB joining the points  $A(1,2)$  and  $B(1,-2)$
- Find the mass of the lamina of the region included between the curves  $y = x, y = 0, x = 2$  having uniform density.

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SV-623

Seat No.	
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Total No. of Pages : 3

F.Y. B.Tech. (All Branches) (Semester - I & II) (CBCS) Examination, May - 2019

**APPLIED MECHANICS**

**Sub. Code : 71819**

Day and Date : Monday, 13-05-2019

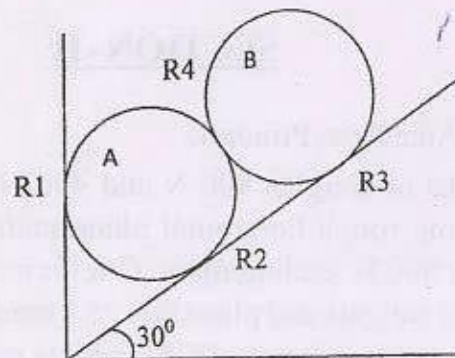
Total Marks : 70

Time : 10.00 a.m. to 12.30 p.m.

- Instructions :
- 1) Solve any three questions from each section.
  - 2) Assume any data necessary & highlight it in answer sheet.
  - 3) Figures to right indicates full marks.
  - 4) Use of non programmable calculator is allowed.
  - 5) Neat sketches should be drawn wherever necessary.

**SECTION - I**

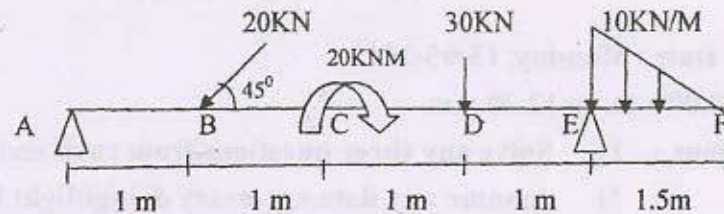
- Q1) a) Define Moment of force & couple. [3]  
b) The resultant of two forces when they act at right angles is 10N. And when they act at an angle of 60 degree, resultant is 12.16. Find magnitude of two forces. [8]
- Q2) a) With suitable example explain Free Body Diagram. [3]  
b) Two identical spheres A and B, each of weight 50 N are supported by an inclined plane and vertical wall as shown in figure. Find reactions at the point of support. Assume all supports are smooth. [9]



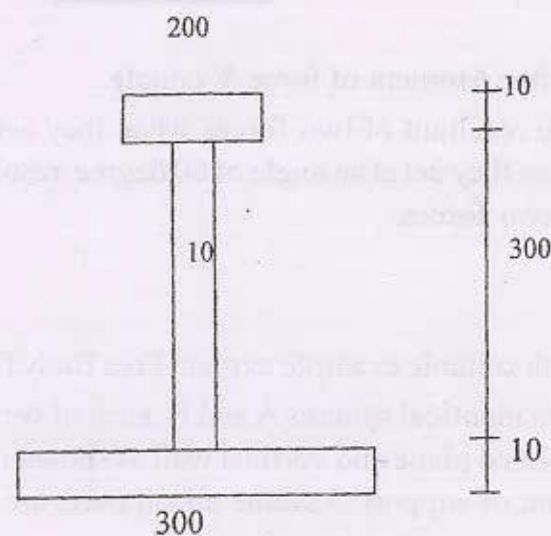
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- 3) a) Explain the principle of Virtual Work. [3]  
 b) A beam ABCDEF is hinged at A and supported on roller at E. It carries load as shown in figure. Determine support reactions. [8]



- 4) a) Define Polar Moment of Inertia and Radius of gyration. [3]  
 b) Determine Moment of Inertia of unequal section shown in figure about its centroidal axis. [9]



### SECTION-II

- 25) a) Define D'Alemberts Principle. [3]  
 b) Two blocks of weights 800 N and 400 N are connected by cable and pulled along rough horizontal plane under the action of force 500 N applied to 800 N leading mass. Coefficient of friction between sliding surfaces of weights and plane is 0.25. Determine acceleration of weights and tension in string using D'Alemberts principle. [8]

- 26) a) Explain in brief Kinetics and Kinematics. [3]  
 b) A block weighing 2500 N rests on a horizontal plane for which coefficient of friction is 0.20. This block is pulled by a force of 1000 N making an angle of 30 degree to horizontal. Find velocity of the block after it moves 30 m starting from rest. Use work energy principle. [9]
- 27) a) Define centripetal and centrifugal force. [3]  
 b) Determine angle of banking for a highway curve of radius 180 m designed to accommodate cars travelling at 80 Km/h. Given coefficient of friction between tyres and road is 0.6. [9]
- 28) a) State Law of conservation of momentum. [3]  
 b) A sphere of weight 12 N moving at 4 m/s strikes another sphere of weight 60 N moving in the same direction at 0.8 m/s. Find velocities of both bodies after impact and show that direction of motion of first sphere is reversed, if coefficient of restitution is 0.75. [8]





SV - 609

Total No. of Pages : 3

Seat No.	
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**First Year Engineering (All Branch) (Semester - I&II) Examination,  
April - 2019**

**ENGINEERING PHYSICS (Revised)**

**Sub. Code : 59176**

Day and Date : Saturday, 27 - 04 - 2019

Total Marks : 100

Time : 10.00 a.m. to 01.00 p.m.

- Instructions :
- 1) All questions are compulsory.
  - 2) Figures to the right indicate full marks.
  - 3) Given: - Avogadro's number =  $6.02 \times 10^{26}/\text{kg.atom}$   
Planck's constant  $h = 6.626 \times 10^{-34} \text{ J.s}$   
Electronic charge  $e = 1.6 \times 10^{-19} \text{ C}$   
Electron mass  $m = 9.1 \times 10^{-31} \text{ kg}$

**SECTION - I**

**Q1)** Attempt any three from the following questions.

- a) Explain in detail construction and working of Lorentz's half shade polarimeter. [6]
- b) Explain the theory of plane diffraction grating and obtain grating equation. [6]
- c) What is diffraction? Explain the construction of the diffraction grating. [5]
- d) Define optical activity. A length of 20cm of sugar solution containing 50gm of solute per liter causes a rotation of plane of polarization of light by  $6^\circ$ . Find rotation of the plane of polarization by a length 60cm of solution containing 100gm of solute per liter. [5]

**Q2)** Attempt any three from the following questions.

- a) Explain the terms Absorption, Spontaneous emission and Stimulated emission. [6]
- b) Explain the principle and construction of optical fibre with neat diagrams. [6]
- c) Explain in brief industrial and medical applications of laser. [5]
- d) Define numerical aperture. An optical fibre has a numerical aperture of 0.13 and core refractive index is 1.55 in air. Find the numerical aperture in liquid of refractive index 1.29. [5]



P.T.O.



23) Attempt any three from the following questions.

- Explain the different basis for classification of the nuclear fission reactor. [6]
- Write a note on chain reaction. [5]
- Discuss the conditions for nuclear fusion reaction. [5]
- A nuclear reactor converts nuclear energy into electric energy with efficiency 30%. If the reactor supplies energy 1500MWh per day using  $U^{235}$ . Find the mass of uranium needed for one day operation. Assume that the energy released per fission of  $U^{235}$  is 200 MeV. [5]

### SECTION - II

24) Attempt any three from the following questions

- Describe any three types of crystal system with axial length, interaxial angle, Bravais types, example with diagram [6]
- Describe the construction and working of Bragg's X-ray spectrometer used for crystal analysis. [6]
- Define the atomic radius. Obtain atomic radius for SC, BCC and FCC [5]
- X ray of wavelength  $1.5 \text{ \AA}$  undergo first order diffraction at  $30^\circ$  from the plane (100) of FCC lattice. Find the lattice constant of this cubic lattice and also find atomic radius. [5]

25) Attempt any three from the following questions

- Explain Heisenberg's uncertainty principle. [6]
- State de-Broglie's hypothesis of matter Waves and derive an expression for wavelength of matter wave in terms of potential difference of particle. [6]

- What is Compton effect? Show that Compton shift depends on scattering angle  $\theta$ . [5]
- Explain properties of matter wave [3]
  - X ray of  $2 \text{ \AA}$  are scattered from carbon block. Calculate the wavelength of the beam being scattered at the angle of  $90^\circ$ . [2]

26) Attempt any three from the following questions

- Explain production techniques used for synthesis of nanomaterials. [6]
- Explain Principle construction and working of Scanning Tunneling Microscope [5]
- State and explain applications of nanomaterials. [5]
- Write note on carbon nanotubes. [5]





- Q5) a) State and explain impulse momentum principle. [4]
- b) An elevator cage of a mine shaft weighing 8kN, when empty, is lifted on lowered by means of wire rope. Once a man weighing 600 N, entered in an lowered with uniform acceleration such that when a distance of 187.5m was covered, the velocity of cage was 25m/s. Determine the tension in the rope and force exerted by the man on the floor of the cage. [14]

OR

- b) A body of mass 30kg is projected up and inclined plane of slope  $30^\circ$  with an initial velocity 10m/s. The friction coefficient between the constant surface is 0.2. Calculate [14]
- Distance travelled before coming to rest.
  - The time required to reach at highest point.
  - Time required and final velocity to return to starting point.
- Q6) a) Define coefficient of restitution. [2]
- b) Explain Perfectly Elastic impact and perfectly inelastic impact. [4]
- c) A ball of mass 20 kg moving with a velocity of 5m/sec strikes directly another ball of mass 10 kg moving in the opposite direction with a velocity of 10 m/sec. If the coefficient of restitution is equal to 0.82, then determine the velocity of each ball after impact. [10]

Seat  
No.

F.E. (All Branches) (Semester - I &amp; II) Examination, May - 2019

APPLIED MECHANICS

Sub. Code : 59185

Day and Date : Monday, 13-05-2019

Total Marks : 100

Time : 10.00 a.m. to 01.00 p.m.

- Instructions :
- All the questions are compulsory.
  - Figures to the right indicates maximum marks for the question.
  - Neat sketches should be drawn whenever necessary.
  - Use of non programmable calculator is allowed.

SECTION - I

- Q1) a) State and explain parallelogram law of forces. [4]
- b) Determine the resultant for force system shown in fig.1.1 and locate it about point 'A'. [12]

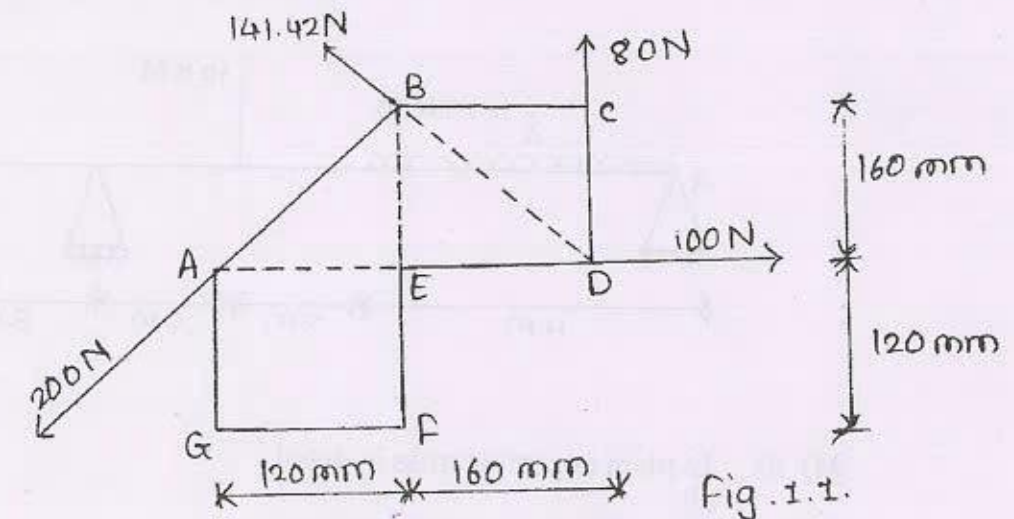


Fig. 1.1.





- a) Write short note on free body diagram. [5]  
 b) Two spheres A and B of radius 90mm and 30mm rest on 3 planes as shown in fig.2.1 the weight of sphere A is 60N and sphere B is 30N. Determine the support reaction at point of contact. [13]

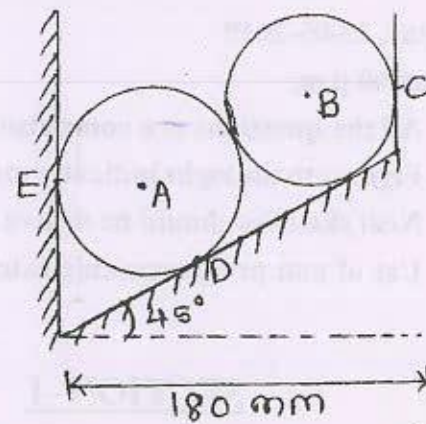
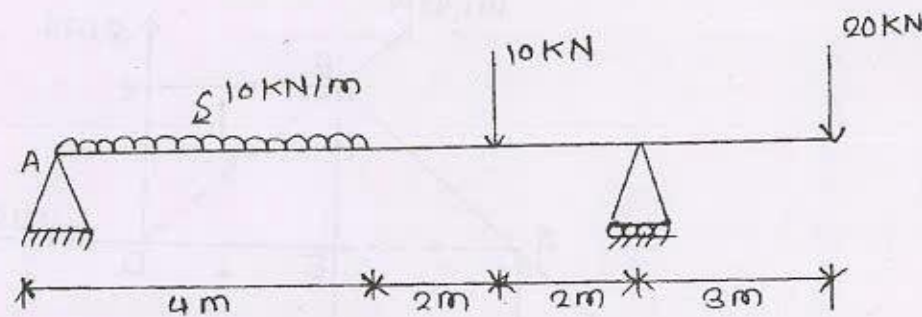


Fig. 2.1.

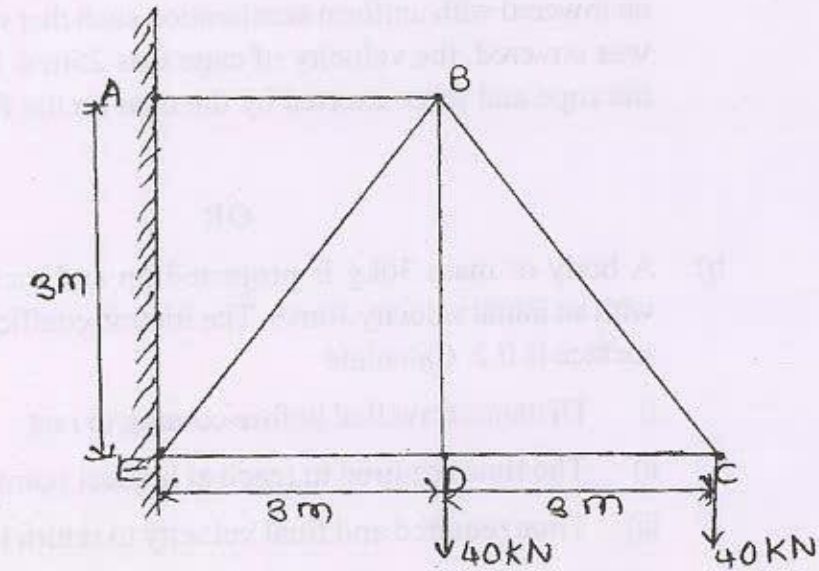
OR

- b) Determine support reaction for the compound beam as shown in figure by using virtual work method. [13]



- 23) a) Explain imperfect truss in detail. [4]

- b) Determine the forces in all the member of the truss shown in fig.3.1 [12]

SECTION - II

- Q4) a) State and prove perpendicular axis theorem. [4]  
 b) Calculate moment of inertia of the shaded area about x-x axis. Also compute radius of gyration about x-x axis (all diagrams are in mm). [12]

